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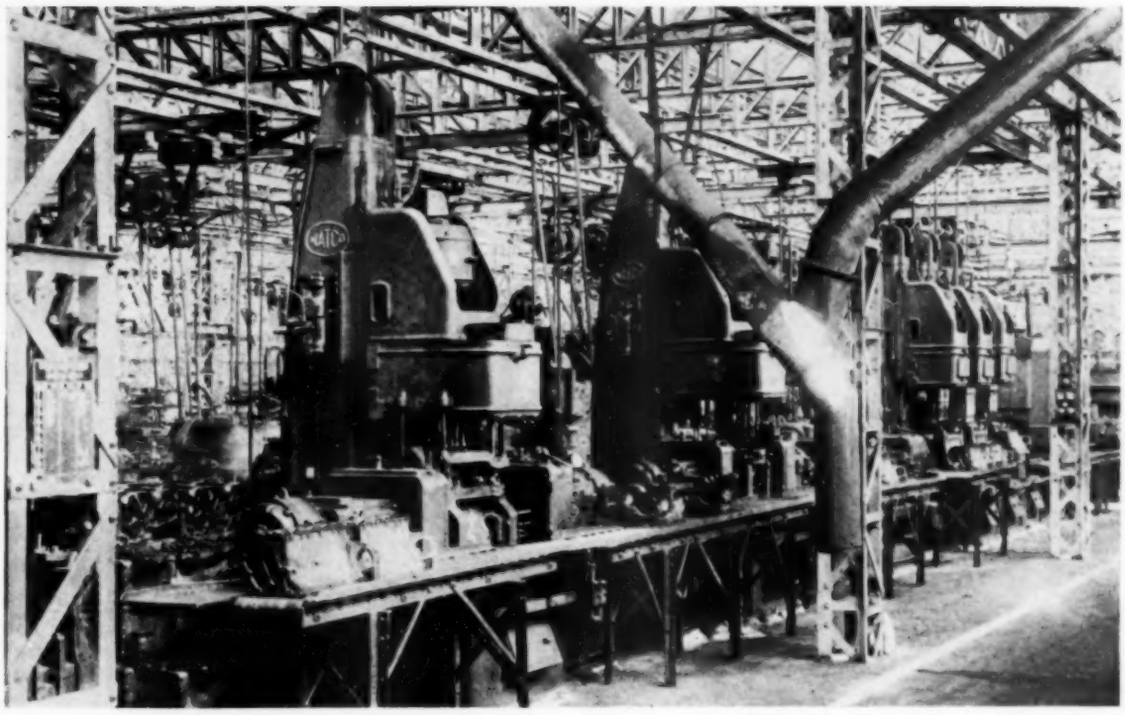


Self-contained hydraulic units for boring and drilling give this French motor manufacturer high production without sacrificing adaptability to change

Versatile Production Lines at Citroen

H. E. MILLS
The National Automatic Tool Company

SOCIETE Anonyme Andre Citroen located at Paris, France, is probably one of the few European manufacturing organizations that constantly takes advantage of the latest developments in manufacturing methods and equipment. Citroen regards modernization as absolutely essential if leadership is to be maintained. They also realize that changes come with little warning and that developments through engineering research must be put into their automobile immediately. The success of such a program, therefore, depends upon flexible, high production equipment which can be changed quickly and with a minimum of cost.

A retooling program has just been completed for their passenger car. Only the latest and most efficient equipment is being used in the various production lines, a large portion of which was purchased from the National Automatic Tool Company. This equipment is performing practically all the drilling, boring and tapping operations on the cylinder block, cylinder head, piston, connecting rod and crankshaft as well as the transmission case, oil pump body, "wish-bone" (for front end assembly) and many other miscellaneous parts.

The equipment consists mainly of standard vertical machines and machines built up of Natco self-contained hydraulic units and tapping units arranged with the patented individual lead screw spindles.

In analyzing many machines which had been built in recent years, it was found that these same machines could have been built of a multiple of but five distinct component parts. They are shown in the accompanying diagrammatic sketch:

(1) Self-contained hydraulic unit, (2) unit bed, (3) fixture pedestal, (4) angle spacer plate, and (5) column. By using special spindle boxes on the units and a special holding fixture, almost any type of machine can be constructed.

Also illustrated are several of the most familiar combinations. Machine No. 1, a one-way horizontal, is composed of one unit bed, one self-contained hydraulic unit, and one fixture pedestal. The addition of a special spindle box and one holding fixture completes the machine.

The addition of another unit bed and another self-contained hydraulic unit arranged with a special spindle box, changes machine No. 1 to a two-way

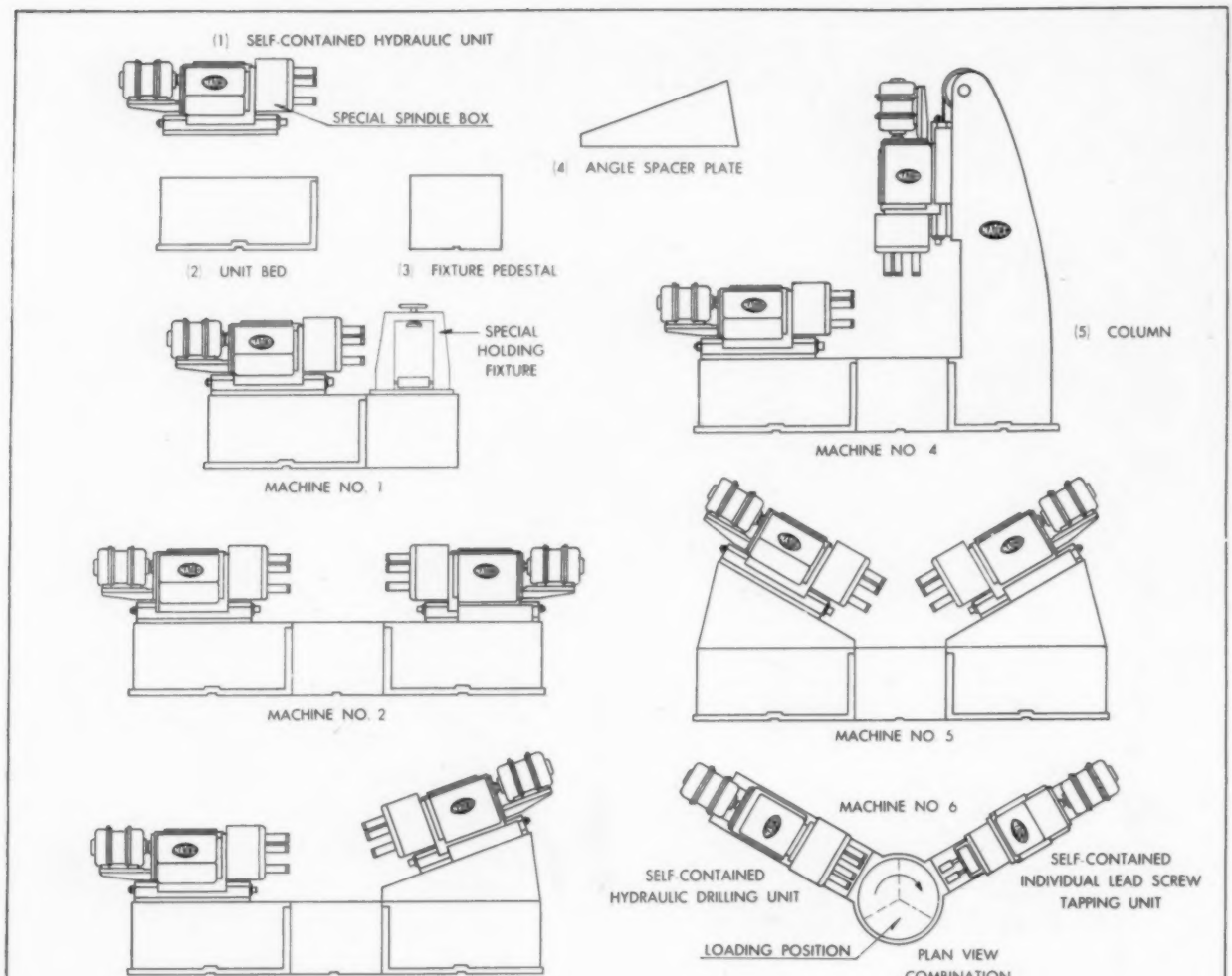


Fig. 2—Five standardized component parts may be arranged to form six basic machine types

horizontal as shown by machine No. 2. By adding an angular spacer plate a unit can be raised and tilted as much as may be required for the new set-up. We now have a two-way with one angular and one horizontal unit. Such a combination is shown as machine No. 3.

Machine No. 5 is a two-way angular machine which could be easily constructed from machine No. 3 by adding another angular spacer plate under the horizontal unit.

Another familiar combination is a two-way machine with one vertical and one horizontal unit. Sometimes called a right angle machine, it can be constructed of one unit bed, one fixture pedestal, one column and two self-contained hydraulic units, one mounted in a horizontal position and the other mounted in a vertical position. Such a combination is shown as machine No. 4.

Machine No. 6 shows a two-way horizontal built of two unit beds, a self-contained hydraulic unit arranged with a spindle box, a tapping unit arranged with a reversing motor drive and box containing individual lead screw spindles and a fixture pedestal. The addition of a three-position rotary table and three special holding fixtures completes another familiar combination which permits drilling and tapping a piece with a single loading. A close study of the diagrammatic examples will show the many "change-over" possibilities of equipment of this type.

The Citroen block is different from the average block in that it is designed for the insertion of sleeve type cylinders. The first seven operations consist of (1) milling upper and lower faces, (2) drilling and reaming the master locating holes, (3) milling front and rear faces, (4) rough and finish milling the bearing slots, (5) milling the length of the bearing slots, (5a) milling the crankshaft bearings and (6) milling the bosses on one side of the block for the gasoline pump. The block is inspected after the above operations.

The cylinder block is then passed down the conveyor for Operation 8. The work is done on a standard vertical machine (Fig. 3 left) equipped with a four-spindle box. The machine is arranged with a three-position, hand-indexed, rotating table on which is mounted a three-position fixture arranged to hold one block in each position. The block is located in the fixture on the finished bottom face over pins in the master locating holes and is unloaded and loaded in the first position. In Position 2 the operations are: combination rough bore, chamfer and cut diameter clearance in first and third cylinder holes. In Position 3 the same operations are performed in the second and fourth cylinder holes. These operations are performed at a rate of over 50 blocks an hour.

The block is then sent to a three-way hydraulic driller (Fig. 3 right) built of one standard vertical machine and two standard self-contained hydraulic units, having a total of 46 spindles. A stationary fixture holds the cylinder block while eighteen holes are drilled in the top, thirteen holes are

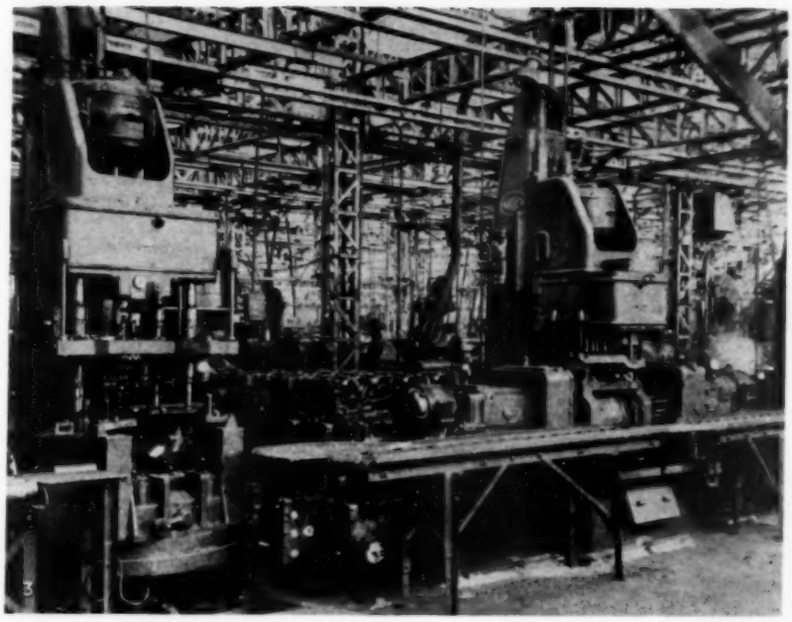


Fig. 3—At the left, a four-spindle machine and, at the right, a three-way hydraulic driller are in place in the cylinder block line

drilled in the front end and fifteen holes are drilled in the rear end. The block is located in the fixture on the finished bottom face over pins in the master locating holes. A production rate of approximately 50 blocks per hour is maintained.

The next station in the line, or Citroen Operation 10, is another similar three-way hydraulic driller (Fig. 4). It is also a standard machine arranged with two self-contained hydraulic units. The three heads contain a total of 38 spindles. As in the previous machine, a stationary fixture holds the block while 28 holes are drilled in the bottom, seven holes are drilled in the valve side and three holes are drilled in the water jacket side. Operations on 50 blocks per hour are completed by this machine.

Operation 11 consists of an inspection of the block covering the four preceding operations. Chamfering all drilled holes in the upper face and the two ends of the block completes operation 12, done with a hand tool.

The block is then passed on to a two-way machine which is built of two hydraulic units. On this machine (Fig. 5) the oil gallery hole is completely drilled through the block. This machine handles two blocks at a time and is arranged with interference bars between the head slides. The latter plus the use of electrical interlocking controls permits the through drilling of holes with opposite heads. A production of 45 blocks per hour is maintained.

Operations 14, 15 and 16, consisting of core drilling, boring and reaming of the eight valve guide holes are performed on three standard vertical machines (Fig. 6). Each is equipped with eight spindles. A stationary fixture on each machine holds the cylinder block at the proper angle, against the finished

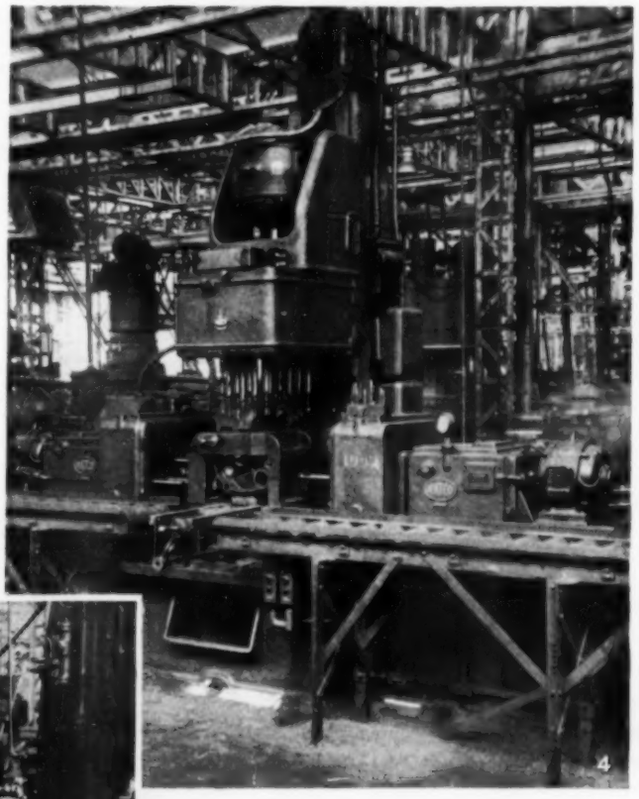


Fig. 4—Thirty-eight holes are drilled by three heads while a stationary fixture holds the block

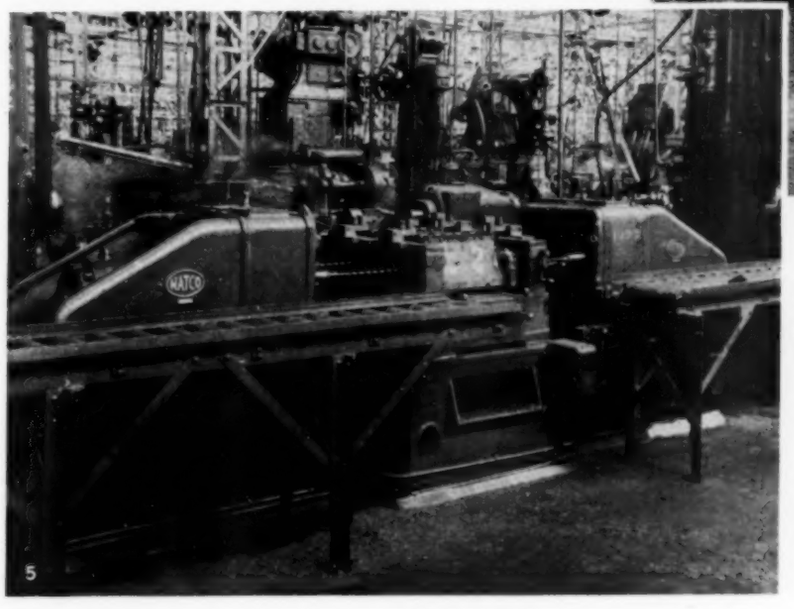


Fig. 5—Oil gallery holes are machined in this two-way equipment composed of two standard hydraulic units

bottom face, with pins in the master locating holes. These machines maintain a production of over 50 blocks per hour.

The cleaning and inspection of the valve guide holes completes Operation 17. Operation 18 consists of lapping the valve guide holes. The chamfering of all drilled holes in the lower face and two ends of the block is classed as Operation 19; this last operation is done with a small hand tool.

The next machine in the line (Fig. 7 left) is a three-way driller built of a hydraulic unit arranged in an angular position and two self-contained hydraulic units opposing each other in a horizontal position. The three heads contain a total of eight spindles. A stationary fixture holds the cylinder block while a boss is faced on the inside of the distributor hole and one hole is drilled in the same plane. The other horizontal head faces one boss and drills two holes in the water jacket side of the block while three oil holes are drilled from the main bearings to the oil gallery by the angular head. The block is located in the fixture on the finished top face with pins in the master locating holes. The production maintained by this machine is approximately 45 blocks per hour.

Operation 22 is performed by a three-way tapping machine (Fig. 7 right) which is arranged with one vertical and two horizontal heads, having a total of 37 individual lead screw tapping spindles. One stationary type fixture holds the block while three holes are reamed and 25 holes are tapped in the bottom, six holes are tapped in the valve side and three holes are tapped in the opposite side of the block. The part is located in the fixture on the finished top face and over pins in the master locating holes. A production rate of over 70 blocks per hour is maintained by this machine.

An inspection of the welsh plug holes then takes place.

Operations 24 and 25 are performed by two similar two-way hydraulic feed machines (Fig. 8). Both are built of hydraulic units, each having one left hand horizontal unit and one rear angular unit. Each machine is arranged with a stationary holding fixture. The blocks are located in the fixtures by jacking up against the finished bottom face and over pins in the master locating holes. The first machine combination rough bores, chamfers and faces the generator hole and drills three oil holes one half the required depth from the crank to the cam bores. The second machine finish reams and faces the generator hole and finish drills the three oil holes from the crank to the cam bores. Both machines maintain

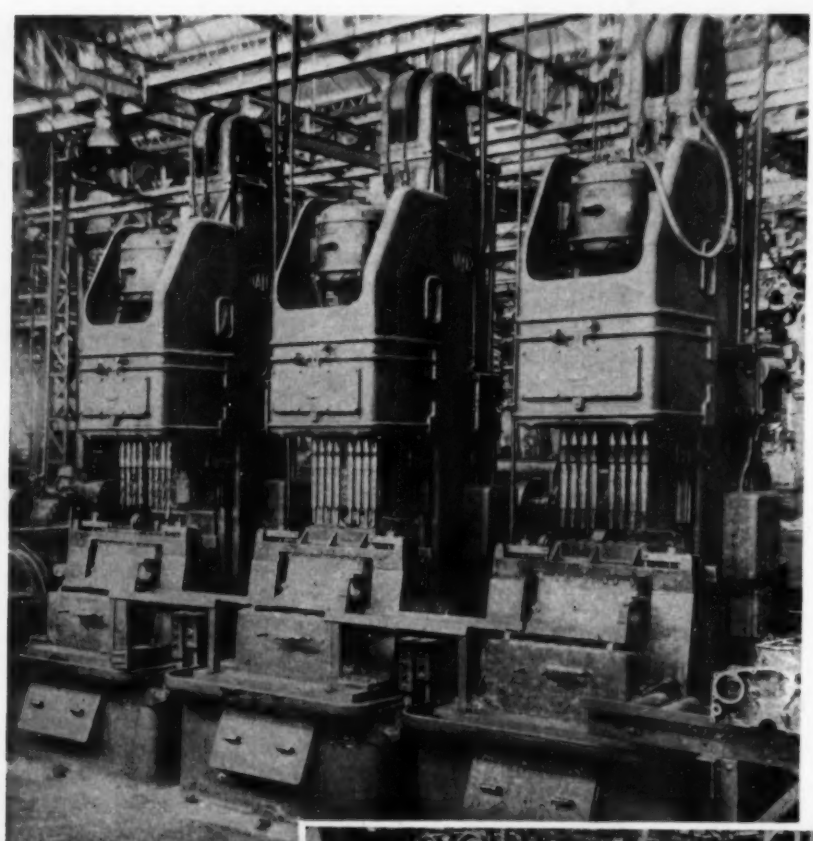


Fig. 6—Three standard Natco machines are installed in the cylinder block line to core drill, bore and ream eight valve guide holes

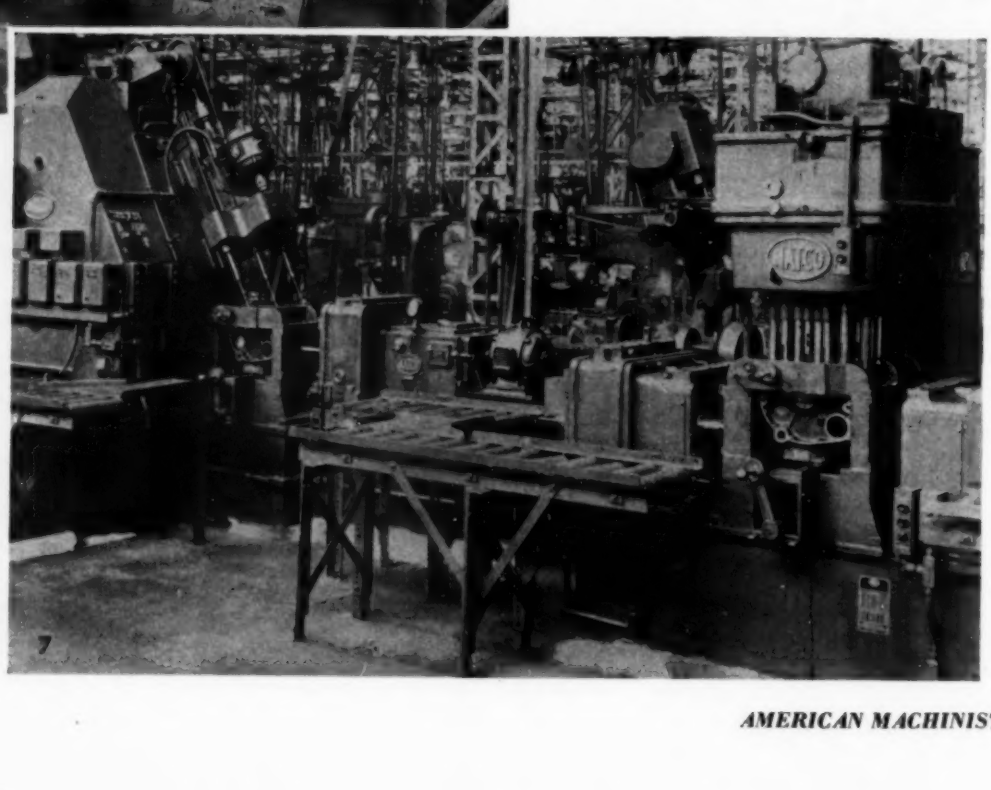


Fig. 7—At the left a three-way hydraulic feed machine drills eight holes, three of which are oil holes drilled at an incline. The machine at the right is made up of three standard tapping units

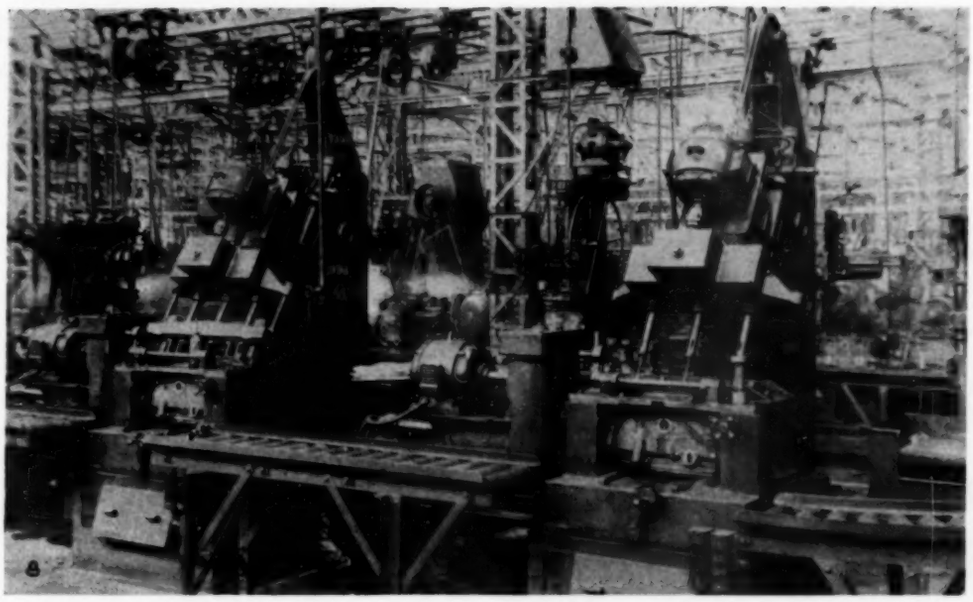


Fig. 8—Generator and oil holes are drilled, reamed and faced by two similar machines with fixtures that guide the block from the top

Fig. 9—The rear view of a three-head, straight-line boring machine for crank and cam bores shows the automatic fixture and conveyor

a production rate of over 45 cylinder blocks per hour.

Operation 26 consists of a 100 per cent inspection of the block after which the bearing caps are assembled to complete Operation 27.

The next machine in the line (Fig. 9) performs the core drilling, semi-finish and finish boring of the cam and crank bores. Built of two self-contained hydraulic units, one hydraulic unit and an automatic indexing straight line fixture arranged with six positions, it is similar in design to equipment used by several American automobile manufacturers for performing the identical operations. One unit is equipped with a special attachment which controls the boring bar action and permits extremely accurate boring. The fixture holds one block in each of four working, one loading and one unloading stations. The blocks are located in the fixture by jacking up against the finished bottom face over pins in the master locating holes. The blocks are advanced automatically hydraulically (loaded and unloaded) into the various stations. Production is about 50 blocks an hour.

The blocks are then passed on to the next station in the line which is known as Operation 29. This machine (Fig. 10 left) is equipped with eight spindles and is arranged with a six-position, hand-indexed rotating table. A six-position fixture, designed to hold one block in each position, is mounted on the rotating table. The operations are as follows: Position 1, unload and load one block; Position 2, core drill and chamfer one hole and drill one hole; Position 3, core drill one hole and spot-face one boss; Position 4, line bore two diameters with a combination tool; Position 5, line ream two diameters with a combina-

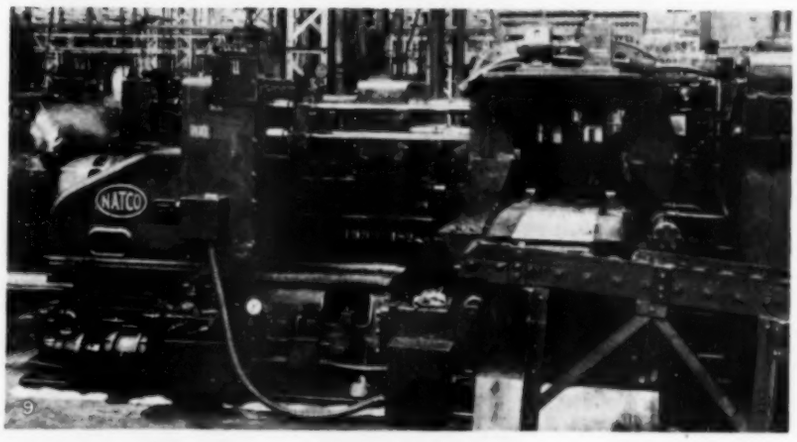


Fig. 10—An eight-spindle, six-position machine and a three-position, five-spindle machine are equpped with rotating tables

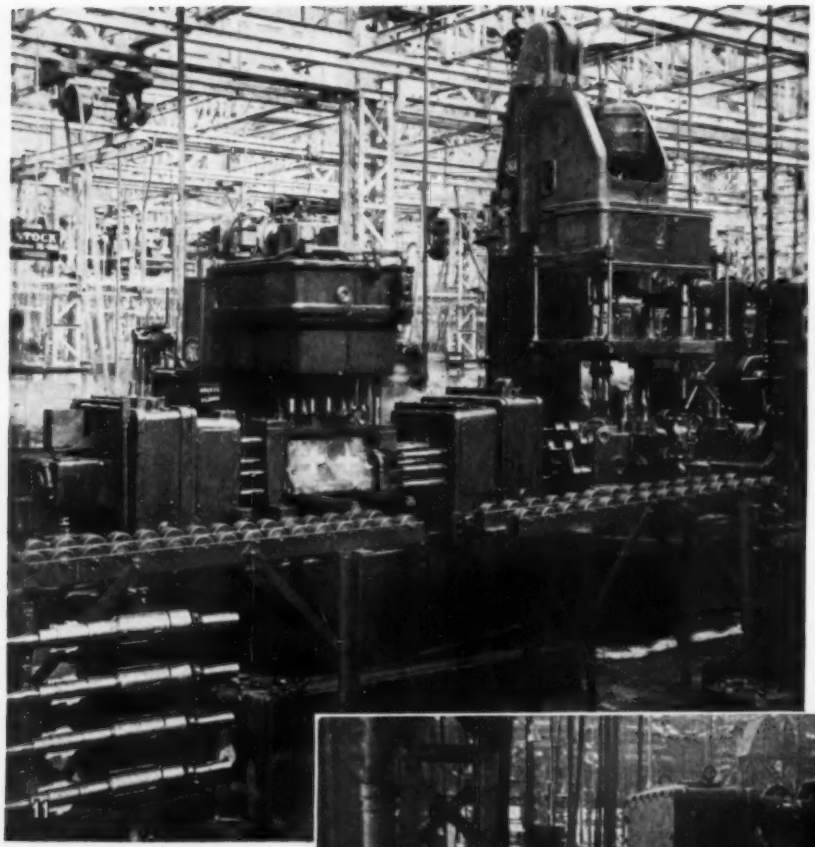


Fig. 11—At the left is a three-way machine with 44 individual lead screw tapping units. At the right is a standard vertical machine with a three-station fixture

Fig. 12—A two-way driller with a four-position trunnion fixture is used in the cylinder head line

a three-position, hand-indexed rotating table on which is mounted a fixture designed to hold one cylinder block in each of the three positions while the following operations are performed. Position 1, unload and reload one block; Position 2, finish ream two alternate cylinder holes; Position 3, finish ream two remaining alternate cylinder holes. Operations are performed at the rate of 65 blocks per hour.

Operation 32 calls for the inspection of the block while Operations 33 and 34 call for the finish milling of the front face and upper faces respectively.

The block is then passed on to a small one-way horizontal machine which is built of one hydraulic unit equipped with a box containing two spindles. A stationary fixture holds the block while two dowel holes located in the front face are finish reamed. The block is located in the fixture over plugs in the cam and crank bores and registers with a pin in the master locating hole. Operations are completed on 85 blocks per hour by this machine.

Operation 36 calls for finishing the bottom seat for the cylinder sleeves and preparing for line reaming. Line reaming and inspection of the bearings completes Operation 37.

The block is then washed, blown clean and the welsh plugs are assembled while Operation 39 calls for the assembling of the cylinder sleeves. Operation 40 is composed of a water test while a 100 per cent inspection of the block completes Operation 41 which is the last and final operation on the cylinder block.

In the entire cylinder block line there are nine standard Natco machines, seventeen standard hydraulic units and six standard tapping units performing a total of 257 individual operations on

tion tool; Position 6, drill two holes. Forty-five cylinder blocks are obtained from this machine per hour.

Operation 30 is performed by a standard machine equipped with five spindles and a three-position, hand-indexed rotating table. A three-position stationary fixture arranged to hold one cylinder block in each position is mounted on the rotating table. The block is located in each fixture over plugs in the cam and crank bores with a pin in a master locating hole while the following operations are performed. Position 1, unload and reload one block; Position 2, semi-finish bore and rough face two alternate cylinder holes and spot face one boss; Position 3, semi-finish bore and rough face the two remaining cylinder holes. The machine maintains a production rate of 45 blocks per hour.

The cylinder block is then passed down the conveyor to a four-way three-headed tapping machine (Fig. 11 left). The three heads driven by individual reversing motors contain a total of 44 individual lead screw tapping spindles. A stationary fixture holds the block while fourteen holes are tapped in the top, two holes are tapped in the distributor hole face, twelve holes are tapped in the front end and sixteen holes are tapped in the rear end. The block is located in the fixture on the finished bottom face over pins in the master locating holes. A production rate of approximately 75 blocks per hour is maintained.

A standard driller (Fig. 11 right) equipped with a box containing four heavy duty spindles is the next machine in the line. It is arranged with

an average rate of over 40 cylinder blocks per hour.

As the Citroen passenger car motor is equipped with overhead valves the cylinder head is somewhat similar to the cylinder heads used on various American overhead valve motors. The first three operations on this part consist of (1) rough mill the top face and intake side, (2) rough mill the bottom face, and (3) mill the two ends.

The cylinder head is then passed down the conveyor to a two-way horizontal hydraulic machine (Fig. 12) built of two self-contained hydraulic units arranged with boxes containing a total of 52 spindles. A four-position trunnion fixture, arranged to hold one part in each position, is mounted on the fixture pedestal. The cylinder heads are located in the fixture against the

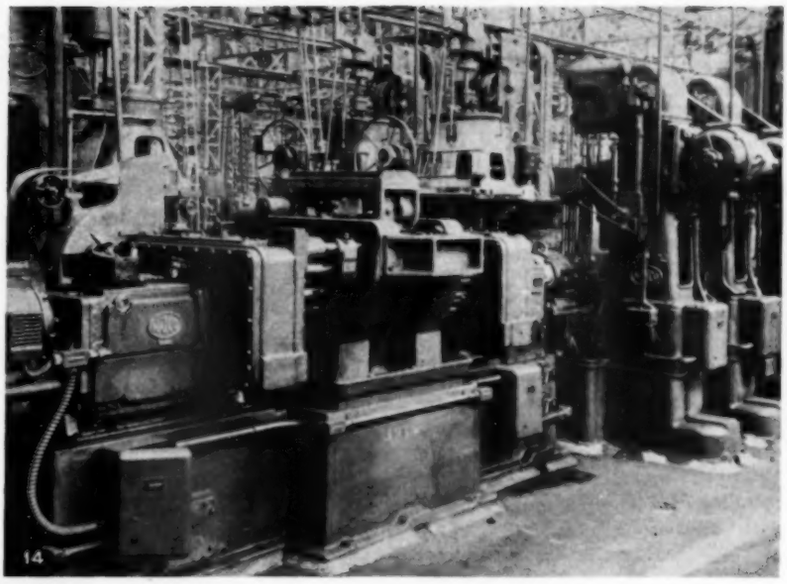


Fig. 14—A three-position trunnion fixture at the left holds one cylinder head in each position. At the right my be seen the equipment for machining the valve stem and valve insert seats

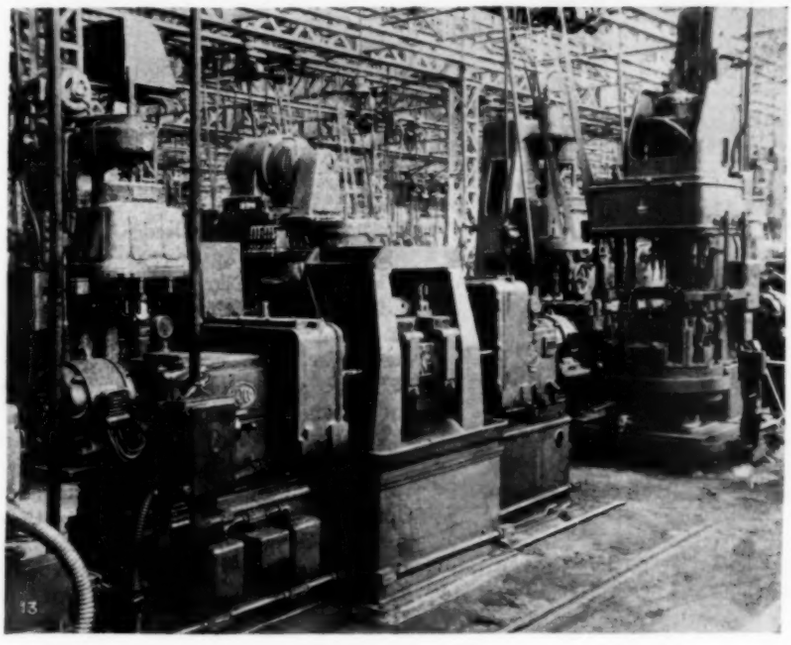


Fig. 13—The two-way machine at the left drills and counter-bores the ends of the cylinder head. That at the right machines the manifold side

finished bottom face, side and one end while the following operations are performed: Position 1, unload and load one part; Position 2, drill fourteen holes in top of part with the right hand head, drill seven holes in bottom of part with the left hand head; Position 3, drill nine holes and core drill three holes in top of part with the right hand head, drill thirteen holes in bottom of part with the left hand head; Position 4, drill one hole and ream three holes in top of part with the right hand head, ream two holes in bottom of part with the left hand head. A production of approximately 54 cylinder heads per hour is maintained.

Operation 5 calls for the profile milling of the combustion chambers.

Operation 6 is performed on a two-way (Fig. 13 left) which is built of two self-contained hydraulic units arranged with boxes containing a total of ten spindles. A four-position trunnion fixture arranged to hold one cylinder head in each position is mounted on the fixture pedestal. The following operations are performed by this machine: Position 1, unload and reload one part; Position 2, drill four holes in the front end with the right hand head, combination core drill and rough counterbore one hole in rear end with the left hand head; Position 3, core drill one hole in the front end with the right hand head, finish counterbore one hole and drill one hole in rear end with the left hand head; Position 4, drill 2 holes in the rear end with the left hand head. This machine maintains a production of approximately 70 cylinder heads per hour.

The next station in the line, or operation 7, is performed by a standard machine (Fig. 13 right) equipped with a box containing fourteen spindles. The machine is arranged with a four-position fixture mounted on a four-position, hand-indexed rotating table, and the cylinder heads are located in the fixture on the finished bottom face over pins in the master locating holes. The following operations are performed. Position 1 unload and reload one part; Position 2, core drill four holes in the manifold side; Position 3, drill eight holes in the manifold side; Position 4, ream two holes in the manifold side. Approximately 90 parts are obtained from this machine per hour.

Operation 8 is performed by a two-way horizontal hydraulic feed machine (Fig 14 left) built of two standard self-contained hydraulic units arranged with boxes containing 24 spindles. A three-position trunnion fixture arranged to hold one cylinder head in each position is mounted on a fixture pedestal between the units. The parts are located in the fixture on the finished bottom face over pins in the master locating holes while the following operations are performed: Position 1, unload and reload one part; Position 2, core drill four valve throat

holes in bottom of part with right hand head; drill eight valve stem guide holes in top of part with the left hand head; Position 3, rough counterbore four exhaust holes for valve seat insert in the head, counterbore eight valve stem guide holes in top of part with the left hand head. Operations are completed on approximately 60 parts per hour by this machine.

Operations 9 and 10, consisting of line boring and line reaming the eight valve stem guide holes plus semi-finishing the four intake valve seats and finish counterboring the four holes for the exhaust valve inserts are done by two similar machines (Fig. 14 right). Both are of the standard design and are equipped with boxes containing eight spindles. Each machine is arranged with a stationary fixture. The parts

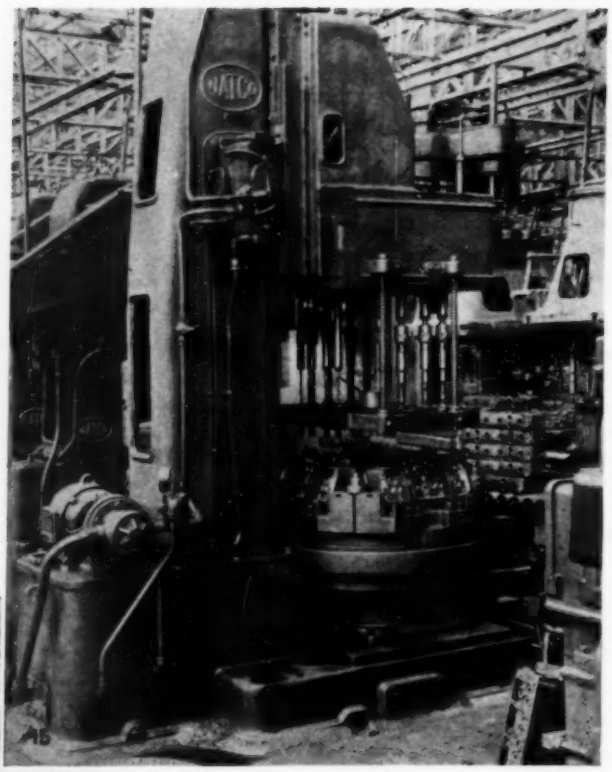
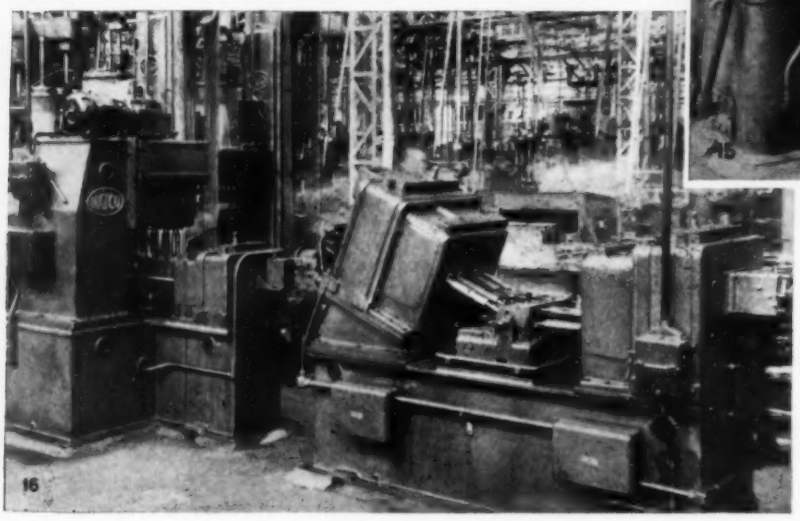


Fig. 15—Four fixtures mounted on a hand-indexed rotating table hold the heads for machining spark plug holes. Fig. 16—Sixteen holes in the cylinder head are tapped with the three-way machine at the left. At the right an inclined head tapper finishes ten holes



are held in the fixtures by jacking them up against the finished bottom face over pins in the master locating holes. Each machine maintains a production rate of approximately 55 parts per hour.

The next machine in the line is a standard (Fig. 15) equipped with a twelve-spindle box. It is arranged with a four-position, hand-indexed rotating table on which is mounted four stationary fixtures, designed to hold one cylinder head in each position while the following operations are performed. Position 1, unload and reload one piece; Position 2, combination core drill and chamfer four holes; Position 3, drill four spark plug holes; Position 4, combination ream and face four holes. Operations are completed on approximately 45 parts per hour.

The chamfering of all small holes in the top face is then done with a small hand tool. This completes Operation 12.

The cylinder head is then passed down the conveyor to a three-way tapping machine (Fig. 16, left). This tapper is arranged with one vertical and two horizontal heads which are equipped with a total of sixteen individual lead screw spindles. A stationary fixture holds the cylinder head while ten holes are tapped in the top, four holes in the front end and two holes in the rear end. The part is located in the fixture over pins in the two previously reamed holes resting on the finished bottom face. This machine is capable of tapping 100 cylinder heads per hour.

The next machine in the line is another tapper (Fig. 16, right) built with one angular and one horizontal head which are driven by individual reversing motors. The two heads contain a total of ten individual lead screw spindles. The cylinder head is located in a stationary fixture over pins in two reamed holes and is held securely on the finished bottom face while six holes are tapped in the manifold side and four holes are tapped in the spark plug side. Approximately 70 cylinder heads are tapped per hour by this machine.

The part is then washed and longitudinal tubing within the head is flared on the ends. Five welsh plugs are then driven in place completing Operation 15. Operation 16 calls for a water test and general inspection of the head.

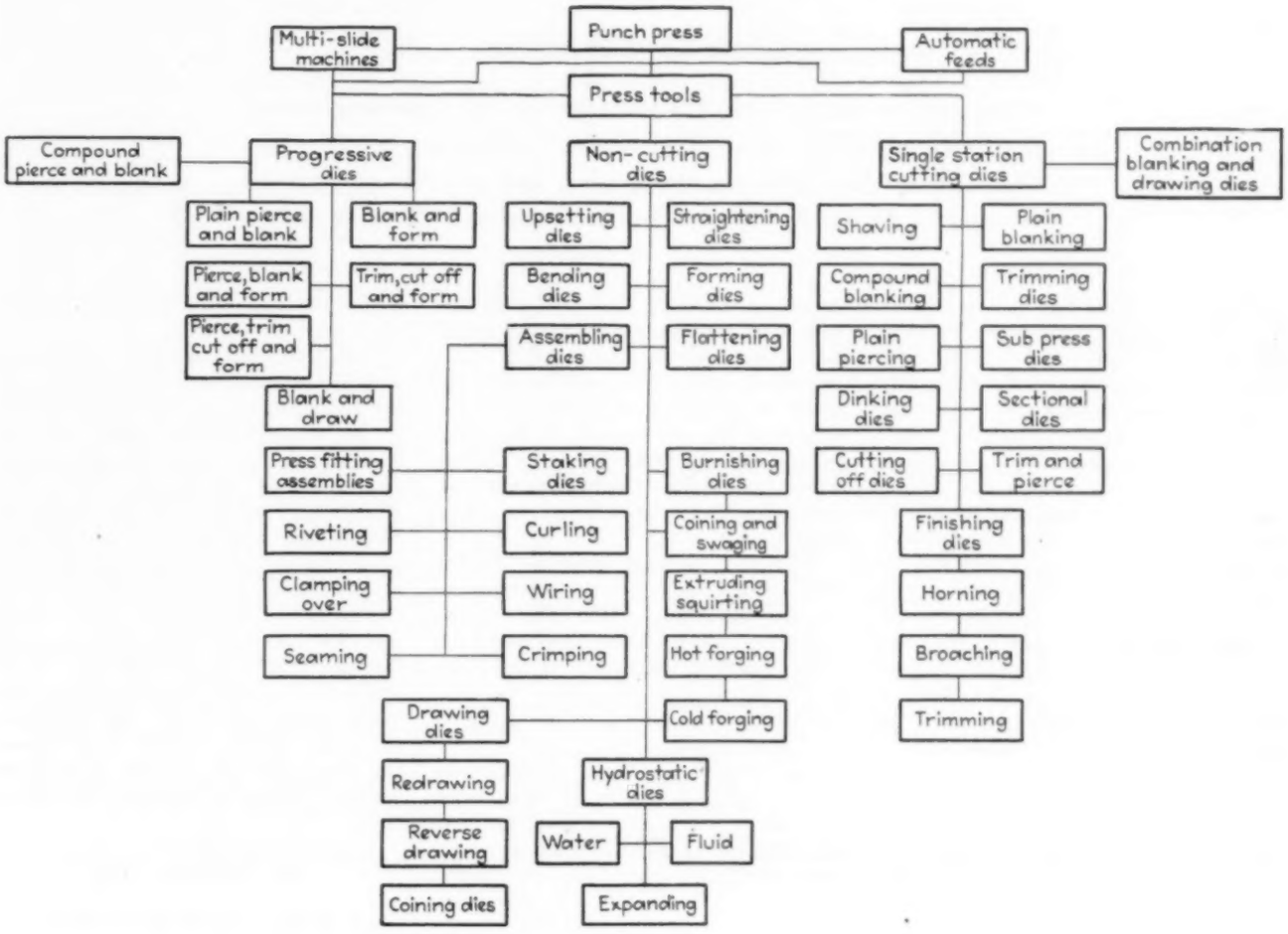
The valve guide bushings are pressed in place and the finish reaming of the valve stem guide holes completes Operation 18. The valve seats are then ground after which the head is sent to a milling machine where the top and exhaust side is finish milled. Operation 21 calls for the finish milling of the bottom face.

The part is then washed and given a thorough inspection, completing the final operations.

In the entire cylinder head line there are four standard Natco machines, six standard self-contained hydraulic units and five standard tapping units, performing a total of 171 individual operations on an average rate of over 40 cylinder heads per hour.

In addition to the two production lines described there are many other Natco machines in the Citroen plant built of unit type construction. They are being used to perform various operations of drilling, boring, counterboring, facing and chamfering on parts made of steel, cast iron and aluminum. The records made by these machines are equal to the average special high-production way machines, yet they are built of standard unit construction.

Classification of Press Tools



C. W. HINMAN

WHILE the accompanying diagram does not contain all the different press tools possible to make, it does present to the designer or manufacturer, a sufficient number of designs, tied together in such a way to suggest a solution for any possible die problem likely to arise.

Press tools can be separated into six classifications:

1. Those that punch out flat blanks, with or without perforated holes, or split, swage, indent, or otherwise change the blanks, but with no portion raised above the surface of the blank.

2. Those that punch out flat blanks, having the same characteristics as the above class, but cause some portion to be formed, bent, drawn embossed, swaged, dished or otherwise changed by a portion being raised above the surface of the blank.

3. Those that do not punch out blanks, but operate only on the strip or on a flat sheet by notching, perforating, splitting, swaging, indenting, shearing off, separating or otherwise changing the piece but with no portion raised above the surface of the piece.

4. Those that do not punch out blanks but operate only on the strip or on a flat sheet having the same characteristics as the above class, but cause some portion of the piece to be formed, bent, drawn, embossed, swaged, dished or otherwise changed by some portion being raised above he surface of the piece.

5. Those that perform operations on blanks or pieces by forming, bending or drawing, or otherwise transforming the shape, but which are tools having no cutting edges.

6. Those that in a special operation flatten straighten, spank, or shave soft castings or other materials; that assemble, stake or rivet together parts; that compress, expand, or upset materials, hot or cold swage to shape, drop forge, coin, squirt, extrude, bend, or form rods, bars, or flat, round or square wire, and other press tools not included in any of the other five classes.

Press tools are classified for the following reasons:

1. These classes cover practically all the press tool designs possible to make, which are a vast number.

2. These classes suggest a convenient order in which to file press tool designs.

3. When press tools are designed for new work, the designer can classify them at once, and easily find other helpful designs in his files, similar to the new job in hand.

4. The classification of varied work, like press tool products, tends to reduce production to a scientific basis. It is, therefore, a step forward.

5. It constitutes a convenient standard for reference in oral or written descriptions of press tools.

Notes on Dural Riveting

ROLAND V. HUTCHINSON

What goes on inside a riveted joint during the squeezing operation is a controlling factor in obtaining satisfactory results. The author bases his notes on observation and analysis of squeeze riveting 17 ST dural rivets ranging in size from 3/32 to ¼ inches

DURAL rivets are generally made in heading machines embodying a one-piece heading die; hence the original size of the rivet wire is slightly below nominal, and the rivet itself is slightly tapered under the head.

As a rivet is squeeze driven, it acts as a compression test piece in a testing machine. Being ductile, the middle of the shank swells in the initial stages of squeezing, and is under restraint by the integral head and by friction at the other end. As squeezing continues, the swelling increases as the rivet fills the hole, and keeps on, increasing the hole diameter after contact. The head is not finally formed until it is easier to flow the metal into the head than to expand further the shank and the surrounding material.

Thus, with a filled hole, the surrounding sheet is subject to radial pressure, the local intensity of which is somewhat proportional to the local rigidity of the sheet.

If the rigidity of the sheet is locally uniform, so is the deflection. When a rivet hole is near the edge of a sheet, the latter is locally less rigid toward the edge, and under local hoop tension elongates here.

The above assumes the force on the rivet to be axial; if eccentric, the shank is bent and the sheets are locally loaded at their outer faces in one direction, at their adjacent faces in the opposite direction during the initial stages of squeezing, and sheet deformation tends to increase.

Effect of Head Shape

The type of head formed has an influence upon the degree of shank swelling and the location of its maximum amount.

Flat headed rivets seem to take less power to squeeze as evidenced by abilities of given squeezers to head up satisfactory flat heads on larger diameter original shanks, than button heads. The flat snap imposes simple frictional restraint on the rivet shank end while the button or mushroom head has an added geometrical restraint.

Consequently the swelling of the shank is usually exaggerated near the surface of the sheet next the flat head being squeeze formed, and slightly nearer the original head when the new head being formed is of button or mushroom type.

Thus the bursting pressure on the sheet is not only non-uniform around the circumference of the rivet shank, but is also non-uniform along the length of the shank in the sheet. Hence there is a tendency of the sheet to curl, that part of it adjacent to the squeezed head lengthening.

Individually all these deformations are of negligible magnitude; it is when their effect is cumulative, as in the case of a long row of rivets in a fairly narrow component, that they begin to assume importance. It is common experience suddenly to run into assembly trouble when such new groups are injected into the shop after a series of smaller groups have been successfully riveted without trouble.

The physical conditions usually forgotten are that the resistance of dural to plastic flow in rivet heading is, at room temperatures, about equal to that of steel, while the modules of elasticity of the dural sheets being riveted is only about a third that of steel. The rivet heads are finish formed plastically in compression, the sheet stretched elastically in compression and hoop tension.

The commercial factors to be considered in pneumatic squeeze riveting are:

Available heading force is a function of squeezed dimensions, condition, and line pressure. The required force is established by rivet dimensions, head shape and hardness. Hence squeeze size, linkage and air pressure are practically established by the extreme cases requiring the maximum forces necessary to make a sound commercial job of the hardest usable rivets. The consequence is that most squeezed rivets are slightly overdriven.

Commercial tolerances on rivet shank lengths are approximately $\pm$ 1/64 in., and the variations in gage of the components to be secured jointly vary with the nominal gage thickness and the over-all dimensions of the parent sheet from whence they came. The two latter variations are those to be expected from good non-ferrous rolling mill practice, neither more nor less. When several thicknesses of material are riveted with one rivet, adjustment of length for head forming may become necessary at assembly. Too long a grip not only provides excess metal for the head but shifts the swelling of the shank toward the sheet adjacent to the head to be formed, increasing tendency to distortion.

Air Cylinder Sizes

For economy of air consumption, and for ease of handling of portable squeezers, the cylinder displacement should be minimum.

Two popular sizes of portable pneumatic squeezers have cylinders of 3½ and 6 in. bore respectively and the mechanical advantage of their simplest linkage arrangement is approximately 3.75:1.

Effective force at the snap is naturally reduced by internal friction of the squeezer, and some tests by the writer indicate, for the customary cup leather packed type, the effective closing force is approximately:

$$F \approx \frac{RP\pi d}{4}\left(d - 1.2h\right)$$

Other tests on pressures in piston ring grooves indicate the desirability in some cases of the fitting of thin hard sleeves in the customary soft aluminum cylinders and substituting automotive type piston rings for the cup leather packing.

Investigation indicates the effective closing force expected to be approximately:

$$F_3 \approx R\pi d\left[\frac{Pd}{4} - \frac{\omega}{5}\left(36 + \frac{13}{9}P\right)\right]$$

$$F_2 \approx R\pi d\left[\frac{Pd}{4} - \frac{\omega}{5}\left(36 + \frac{4}{3}P\right)\right]$$

for three-ring and two-ring pistons respectively. In the above expressions:

P = line pressure
R = mechanical advantage of the linkage
d = cylinder bore
h = height of lip of leather packing
w = width of compression ring.

When such alterations are made the squeezers should be marked for identification and between working periods should be handled in storage like riveting hammers.

Aside from the cylinder mechanism, squeezers may be classed as those giving straight-line motion to the heading tools and those having arculate motion.

To avoid the use of high supply pressure and to enable the use of small bore cylinders it is a great temptation to use linkages of the general nature of toggle pliers. This practice is safe *only* when the arculate motion is limited through the squeezing range, and the use of a given linkage is limited to one diameter of rivet, length of shank, shape of head and thickness of components being secured. There always exists the danger of eccentric loading during heading with consequent bent rivet shanks and parts distortion. While one may readily achieve high mechanical advantages with such linkages, they should be applied with caution and not used indiscriminately.

Where the surfaces of sheets must not be marred, the projection of the rivet shank through the workpieces must be carefully controlled when button or mushroom heads are being formed. If the projection be insufficient the snap comes down onto the sheet and rings it around the head, either wholly or partially as governed by the alignment of the squeezer under load.

Hence when the appearance of the squeezed head is not a prime requisite, the flat squeezed head is generally preferred from the shop standpoint, for both quality and low cost.

Where sheet curling is encountered, it may be helped by driving alternate rivets in alternate directions, when appearance permits, or by reducing air supply pressure.

Edgewise distortion of assemblies is evidence of either bent rivets, overdriving, or a combination of both faults. Squeezer quantity should be checked and corrected if necessary. Samples may be sectioned to check sheet swelling due to overdriving, which if existing may be lessened by reduction of line pressure, reduction of stock for the new head, or by changing slightly the initial clearance between shank and hole. The two latter are somewhat sensitive and should be approached cautiously. Some fabricators have found it desirable to trim rivets to proper length in place and to this end provide portable and handy hand-operated trimming shears. The variations of clearance *area*, that is hole area minus rivet shank area, may easily cover a 3:1 ratio when considering maximum rivet and minimum hole and vice versa, and a slight change of hole restraint caused by change of clearance has on occasion been found to affect the distortion experienced.

Where maximum joint strength with minimum structural weight and distortion are demanded, an appreciation of what goes on in making the humble riveted joint is not amiss.

Tabular data of the type submitted by George Fries (*AM*—Vol. 78, page 284) is valuable. It is unfortunate that his number of specimens observed was not greater. However, they serve as a guide to be modified by shop practice to suit individual conditions.

Press Fits for Car Wheels

FRANK C. HUDSON

MOUNTING wheels and axles is one of the major operations in railroad shop work. One of the wonders of the mechanical world was the old-time machinist who could make all his measurements with home-made calipers and tell within close limits the pressure that would be required to mount the wheel. Shop practice has varied widely and the fact that approximately 100 derailments per year have been traced to faulty mounting indicates a need of much greater uniformity and the adoption of the best methods. The data which follows is authorized by the Association of Manufactureres of Chilled Car Wheels.

Proper wheel fit depends on a number of factors such as: roundness both of axle and wheel bore, uniformity of diameter of the mating parts and the quality of finish on both wheel and axle. With the proper allowance in diameter for the press fit, the pressure required will be fairly uniform. The pressure, however, depends so largely on the factors named that pressure alone is not a safe index of the quality of the fit.

The tables, although representing wheel and axle practice, are equally applicable to any work of a similar nature in which press fits are used. The first table is to guide the shop as to correct pressures. It assumes an average friction coefficient of 12½ per cent. The difference in pressures for cast iron and steel wheels shows the extent to which the hub of the cast iron wheel expands under pressure. Tables II and III are for the designer, the thickness of effective hub metal being useful in work other than car wheels.

The relation of the various factors is as follows:

$$\text{Total radial pressure} = \frac{\text{ram pressure}}{\text{coefficient of friction } (12\tfrac{1}{2}\%)}$$

$$\frac{\text{Radial pressure}}{\text{per square inch}} = \frac{\text{total radial pressure}}{\text{area of wheel seat in contact with hub of wheel}}$$

$$\frac{\text{Circumferential}}{\text{stress in hub}} = \frac{\text{radial pressure}}{\text{per square inch}} \times \frac{\text{diameter}}{\text{of bore}} \times \frac{\text{length of}}{\text{hub}}$$

Table I—A. R. A. Standard Ram Pressures

Journal Size	Nominal Wheel Seat Diam.	Ram Pressure, Tons					
		Cast-Iron Wheels			Steel Wheels		
		Min.	Normal	Max.	Min.	Normal	Max.
4½x8	5¾	35	50	60	55	70	80
5 x9	6½	40	55	65	70	85	100
5½x10	7	45	60	70	75	90	110
6 x11	7⅝	50	65	75	80	100	120

Tests indicate that an allowance, or interference, of 0.003 in. in diameter for a 7-in. bore would give a ram pressure, if both axle and wheel bore were round, true and smooth. As these conditions are not obtainable in ordinary shop practice, the allowance is doubled, making 0.006 in. the minimum allowance advised. A plus tolerance of 0.003 in. is advised, making the allowance from 0.006 to 0.009 in. for a 7-in. axle. This conforms closely to the old established allowance of 0.001 in. per inch of diameter. It also shows the advantage of accurate machining of both axle and wheel bore and gives advocates of grinding an excellent argument.

Experiments show the relation between hub area and pressure required indicate that with the allowance of 0.006 to 0.009 in. on a 7-in. axle it requires 1 ton of pressure for each 0.611 sq. in. of axle sectional area at the wheel fit. This does not refer to surface contact but to length of fit multiplied by axle diameter. The surface equivalent, found by multiplying by 3.1416, gives one ton of pressure to each 1.9 sq.in. of contact area.

Ram pressures should increase as the axle advances into its seat because of the greater surface contact. Should the pressure not increase it indicates a lack of proper interference, or allowance, in parts of the fit of either axle or bore. If, as has happened, the pressure decreases before the axle is in place, the fit is poor because of insufficient interference beyond the point of entrance. It is for this reason that recording pressure gages are so desirable.

Table II—Radial Pressure and Hub Stress

Assuming an average coefficient of friction of 12½ percent, the following normal radial pressures are established between the hub of wheel and wheel seat of the axle, also the stress tending to split the hub:

Tons Normal Ram Pressure	Total Radial Pressure on Wheel Seat	Diam. Wheel Seat In.	Circumference Wheel Seat, In.	Length of Contact, In.	Sq. In. Contact Wheel Seat and Wheel Hub	Radial Pressure Per Sq. In Contact	Total Circumferential Stress in Hub
50	800,000	5¾	18.064	6½	117.4	6810	255,000
55	880,000	6½	20.420	6½	132.7	6630	280,000
60	960,000	7.0	21.991	6½	142.9	6720	306,000
65	1,040,000	7⅝	23.955	7⅛	170.7	6090	331,000

Table III—Circumferential Hub Stress, Strain and Tolerance

Thickness of Effective Hub Metal	Length of Hub, In.	Longitudinal Sectional Area of Hub Metal in Square Inches		Circumferential		Tolerance In.
		One Side	Two Sides	Stress Per Square In.	Strain Per In.	
2.25	7	15.75	31.50	8100	.00037	.0024
2.375	7	16.62	33.25	8450	.00040	.0026
2.50	7	17.50	35.00	8750	.00043	.0030
2.75	7.625	20.62	41.24	7900	.00036	.0028

Lubricants Compared

Table IV contains interesting data on ram pressures. Included are initial pressure, pressure per unit of advance, final pressure and pressure required to remove the wheel from the axle, with different allowances. Progressive and press-off pressure are also given in percentages of the final pressure. The effect of different lubricant is also given. A.R.A. lubricant is 12½ lb. of white lead per gallon of linseed oil. The other lubricants used were 25 to 1 and 60 to 1. A comparative study of the pressure required with the different lubricants is of interest.

Uniform machining is indicated in all cases as the pressure increase is very regular. As the recommended A.R.A. pressure for a 7-in. axle is 60 tons, the table shows that an allowance of 0.005 in. did not give the required pressure, but that 0.009 in. was necessary. Beyond an allowance of 0.015 in. (or 0.002 in. per in. of diameter) pressure becomes irregular, due to stretching of the metal in the hub. With an allowance of 0.033 in., for example, the final pressure is less than for the 0.011-in. allowance. This shows that excessive allowances do not secure a tight fit. The same is true in making allowances for shrink fits.

Heavier lubricants, both 25 to 1 and 60 to 1, require less pressure than the standard A.R.A. mixture. As the A.R.A. lubricant gives the desired pressure with less allowance, and consequently with less tendency to distort the hub, the heavier mixtures are not recommended. The lead and oil should be mixed and time given for oil to permeate thoroughly. As the oil evaporates appreciably it is advised that only a week's supply be mixed or it should season a day before being used.

The press-off pressures are also of interest in all work of this kind.

Wheels and axles that have been pressed together and then removed both show a permanent set. The axles tested were smaller by from 0.001 to 0.003 in. through a range of fit allowances of from 0.006 to 0.040 in. Wheel bores were enlarged to a greater extent, from 0.0025 to 0.023 in. at the front hub, to 0.003 to 0.034 in. at the back hub, for similar press allowances. The bore of the wheel becomes tapered, this being marked when the press allowances are large.

Table V shows the permanent set found in both wheels by a large number of tests. These show clearly the folly of excessive allowances. In all cases the large allowances tend to reduce themselves to standard after a number of mountings and removals. Large allowances simply mean greater deformation of the material which sets up dangerous stresses, especially on the hub.

Numerous tests indicate that over half the wheels removed from axles require reboring. This is not on account of enlarged bore but because of lack of concentricity with the worn tread of the wheel, taper or out of roundness. Some consider it cheaper to bore all wheels than to take the time to check each diameter carefully for the defects named. In few cases is there danger of the bore being oversize if care is taken in reboring.

The bore should be made concentric with the worn tread. It is also advised to mark the thicker section of the flange on the wheels while they are on the boring mill. The thick, or heavy portion of one wheel should be mounted opposite the thin, or light portion of the mating wheel, when they are pressed in place.

Axle turning requires attention to the centers and to the tools. Many old axles had a 77-deg. center, while the new A.R.A. standard is 60 deg. and conforms to general practice. The centers should be inspected before turning and either recentered or used on proper lathe centers.

In re-turning axles it is important to remove as little metal as possible, as each 0.001 in. removed represents approximately 20 cents in material. This is based on an average axle cost of $27.91 and a scrap value of $3.59. As the allowable difference in diameter between a new axle and one which must

Table IV—Ram Pressures and Percentage of Final Pressure at Each Inch Advance of 7-in. Axle Into Hub Tests Made at Galesburg Shop of C. B. & Q. R. R.

Inches Advance of Axle Into Hub	KIND OF LIBRICANT USED											
	A.R.A.		A.R.A.		A.R.A.		25-1		25-1		A.R.A	
	ALLOWANCE OR INTERFERENCE											
	.005 Inch		.009 Inch		.011 Inch		.014 Inch		.015 Inch		.015 Inch	
	Tons Press.	% of Final Press.	Tons Press.	% of Final Press.	Tons Press.	% of Final Press.	Tons Press.	% of Final Press.	Tons Press.	% of Final Press.	Tons Press.	% of Final Press.
1	8	18.6	11	17.5	20	24.0	18	25.0	10	20.0	21	24.0
2	12	28.0	20	32.0	33	40.0	30	42.0	20	40.0	40	46.0
3	20	47.0	30	48.0	49	60.0	42	59.0	30	60.0	51	59.0
4	29	67.0	40	63.0	60	73.0	50	69.0	40	80.0	70	81.0
5	36	84.0	52	83.0	77	94.0	65	91.0	50	100.0	80	92.0
6	41	95.0	60	95.0	80	98.0	70	97.0	50	100.0	87	100.0
7	43	100.0	63	100.0	82	100.0	72	100.0	50	100.0	87	100.0
Press Off	55	128.0	75	119.0	95	116.0	80	111.0	65	130.0	110	127.0

	60-1		A.R.A.		A.R.A.		60-1		A.R.A.		A.R.A.		A.R.A.	
	.016-.019		.018		.023		.031		.032-.033		.031-.033		.033	
1	8	18.0	19	26.0	18	26.0	10	15.0	30	30.0	18	22.0	12	17.0
2	12	27.0	25	34.0	29	41.0	18	28.0	45	35.0	28	35.0	27	38.0
3	20	45.0	39	53.0	38	54.0	38	58.0	60	60.0	45	56.0	39	55.0
4	30	66.0	51	70.0	45	64.0	45	69.0	71	71.0	60	75.0	60	85.0
5	40	89.0	62	85.0	60	86.0	58	89.0	90	90.0	72	90.0	62	87.0
6	45	100.0	70	96.0	69	98.0	63	97.0	99	99.0	79	99.0	70	99.0
7	45	100.0	73	100.0	70	100.0	65	100.0	100	100.0	80	100.0	71	100.0
Press Off	65	145.0	90	123.0	80	114.0	90	138.0	120	120.0	118	123.0	85	120.0

Table V—Permanent Set of Metal in Wheel and Axle

Original Allowance	Permanent Set in .001 In.					Final Allowance in .001 In.	Number of Tests
	Axle		Wheel		Average Total		
	Front	Back	Back	Front			
.006	1.66	1.88	2.92	2.75	4.605	1.395	13
.007-.009	1.56	1.83	3.17	2.50	4.580	3.420	12
.010	2.18	2.00	4.00	3.50	5.840	4.160	18
.011	2.00	2.00	4.60	4.10	6.350	4.650	8
.012	1.30	1.60	4.00	.....	3.950	8.050	3
.013	1.67	2.00	5.67	3.83	6.585	6.415	6
.014	1.80	1.67	5.70	4.92	7.045	6.953	13
.015-.016	2.66	2.33	6.71	5.57	8.635	6.865	7
.017	1.33	1.75	7.00	6.00	8.040	8.960	6
.018-.019	2.26	2.00	8.63	6.44	9.645	8.855	19
.021	2.66	2.50	11.25	8.50	12.455	8.545	4
.022	2.00	4.00	13.00	8.00	17.455	9.950	3
.024	1.75	1.00	14.20	10.60	13.775	10.225	5
.025	2.60	1.40	14.30	12.20	15.250	9.750	6
.028-.033	2.00	1.25	18.70	16.20	19.075	11.425	6
.035	3.00	4.00	26.00	18.00	25.500	9.500	1
.044-.045	3.00	.....	34.00	23.00	31.500	13.000	1

be scrapped is but ¼ in. the need for care in the interest of economy becomes apparent. Advocates of grinding claim that axles can be trued with the removal of less metal by that method than by turning. They also claim a better surface than by rolling. This feature is also brought out in the mounting and demounting of wheels; the claim is made that wheels can be pressed on and off several times without distorting either axle or bore.

Characteristics of Worm Gear Holes—Correction

Equations 15 and 16 (*AM*—Vol. 78, page 468) should be changed to read as follows:

$$\text{Adjusted } \Delta f_{s.} = \frac{2\pi Z \sin^2 \beta_w (L_w - L_t)}{Ng (2\pi Z \sin \beta_w + L_t \cos \beta_w)} \quad (15)$$

and

$$\text{Adjusted } \Delta f_{s.t} = \frac{2\pi Z \sin^2 \beta_w (L_t - L_w)}{Ng (2\pi Z \sin \beta_w + L_t \cos \beta_w)}$$

Equation 9 (page 467) should be made to agree with Equation 9 as it reads under Fig. 3 on the same page. On page 469 Column 1, "work helicoid" should read "worm helicoid."

The first line of the last paragraph in Column 1, page 504, should refer to Fig. 5 instead of to Fig. 2. The left-hand term of Equation 32, page 504, should be $\Delta p\sigma$, and at the end of Paragraph 3, Column 3, on page 305, $-f$ should be Δf.

Polishing and Buffing Costs

JOHN E. HYLER

Perhaps nothing else is so disheartening as to have worked out a production schedule which permits getting out a manufactured item at a reasonable cost, only to have all of the advantages gained thereby, absorbed in the high costs of polishing and buffing. On many types of products, these costs may be almost negligible, but on many others they will be exceptionally high. Machine and tool trimmings requiring a high polish in order to look well, are usually time-consumers to a great degree. Parts used as trimmings on adding machines, typewriters and other business machinery, wrenches, pliers, sewing machine parts and numerous others which might be mentioned, especially products finding their way into domestic use, fall into this classification.

These high polishing and buffing costs have of necessity added largely to the price of such products, and as a direct result have curbed the market for them to a considerable extent. It appears that in the future, hand polishing on such items will be definitely in the discard—in fact it has already been discarded by many, in favor of special polishing and buffing machines having continuous feed, and arranged on the unit system. As many wheel stands may be arranged in series as may be required to handle with dispatch and efficiency the product in hand. With such an arrangement, costs of production drop even while production itself steps upward.

Gages for Final Inspection

FRANK HARTLEY

APART from and in addition to the gaging arrangements used during manufacturing operations, it is the practice in some plants to use master inspection gages that check the accuracy of all the operations performed on several machines using different sets of tools. It should be noted that gages for final inspection are often of different construction from those used in making the parts, since the working gages are for checking successive operations only, while the master inspection gages check the completed work without reference to the jigs, fixtures or the methods used in producing the work.

A small but important type of gage is illustrated in Fig. 1. It is for the inspection of a group of radial holes drilled through he end of the stud *A*. The stud has a keyseat at *B*, and the sleeve-type gage *C* is located by the special screw *D* engaging the keyseat. The gage is knurled and is ground for a slip fit over the end of the stud, where it held against the shoulder by hand to permit the pin gage *F* to be put through the holes. The pin gage has a loop for gripping purpose and is slightly larger in diameter than are the cotter pins that are used to hold a nut on the threaded end of the stud. Gaging the work in this manner insures the proper check for location of the holes.

A gage for checking the relative positions of holes, is shown in Fig. 2. The work *A* has several drilled bosses, two of which, *B* and *C*, are used as principal locating points. The framework *D* of the gage is cast iron. The work is located by pins engaging the holes through the bosses *B* and *C*. The pins are of such diameter that as the work is slipped over them they are a snug fit if the holes have been properly located. A plug gage is used for checking the diameter of the holes, so that the only possible error is in either the alignment or the location of the holes.

Sidewise location of the work in relation to the gaging fixture is obtained by sliding the work on the block *F*, which fits between inner finished surfaces of the two bosses *H* of the work. One of the locating pins is made to slide back so that the work can be swung clear of the hardened block *F* while putting it in place. The hole in boss *J* is gaged by the plug *K*, and the hole *L* is gaged for location by inserting plug *M* through the gaging fixture and into the work.

The threaded plug *N* is run part way into the tapped hole *O* and is then removed and is run through the bushing *P* and into the other tapped hole *S* in the same boss-unit. The last hole is checked by running the plug *T* into the upper hole of the work at *V*. The tapped holes in the work should be so that the threaded plugs will be a running finger-fit. All the gaging plugs are hardened and ground, and bushings are provided in the body of the gage for substantial wearing surfaces. A gage of this type provides the inspection department with an important check on work that is done in the production department in a drill jig.

Where gages are used for final inspection of different parts of the same piece, it is sometimes advisable to assemble them as shown in Fig. 3. Four different types of gages are mounted on the bar *A*. Gage *B* is a limit gage for shoulder length. Gage *C* is for checking a flat section Gage *D* is a snap gage for checking the diameter of a projecting pin. Gage *F* is for checking the width of a slot. While the illustration shows a simple set-up, the bar will hold a combination of gages.

It is sometimes difficult to gage work having threaded combinations, particularly where radial and lengthwise positions must be held in

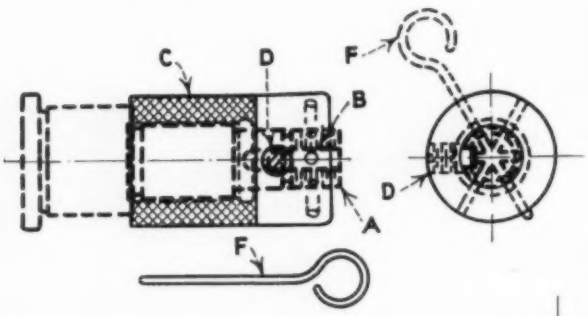
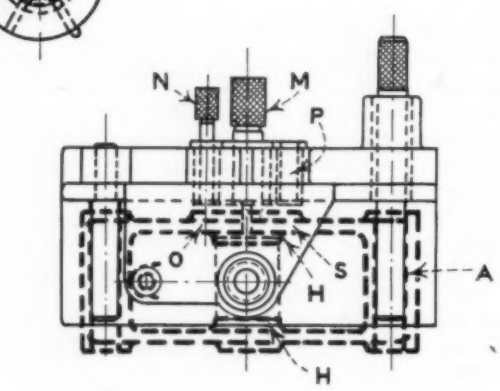
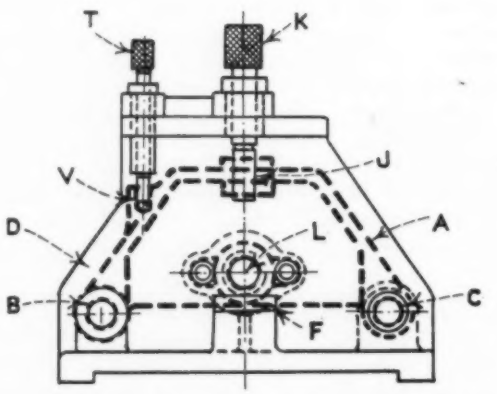


Fig. 1—A group of radial holes drilled near the end of a threaded stud is checked for size and location by this sleeve-type gage





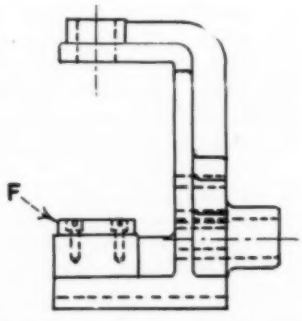


Fig. 2—Gage for relative positions of several holes. The work is located in the gage by pins passing through holes in two of the bosses

certain relations to the threads. One such difficult situation was handled by the gage in Fig. 4. The work *A* is circular except that both sides of the larger diameter have been flattened, as may be seen at *B* in the end view. It will be noted that the boss at the left-hand end is fully cylindrical, while the large diameter is narrowed so that its width is but slightly greater than the diameter of the boss. An internal Acme thread is cut in the work, as indicated at *C*, and the cross hole *D* must be in certain relation to the thread. The machining of the end at the right is gaged by the feeler *F*, the opposite end is checked by the feller *H*, while the inside boss is checked by the feeler *J*.

Since the flatted part of the work opens up a wide slot at both sides of the threaded length of the work, the small end of gage *K* is pushed lengthwise through hole *L*, with the flat of the threaded portion of the gage at a right angle to the position shown. The gage is rotated a quarter turn engaging the gage threads with the work threads, which is the position shown. The gaging pin *M* is then entered into the cross hole *D* in the work and into a corresponding hole in the gage. The proper entrance of the gaging pin shows whether or not the hole has been correctly located in relation to the threads in the machining operation.

This gaging is the first check on the work, and the work is so located radially on line threads of the gage that other points can be inspected by using feelers of the "go" and "not go" type shown in the upper right-hand corner of the illustration. When the feeler *F* is placed between collar *N* on the gage and the end *O* of the work, the "go" and "not go" steps will prove whether or not the work has been faced off to the correct length relative to the threads within the permissible limits. In similar manner the feeler at *H*, when interposed between the end of the boss and the gage at *P*, will test the overall length of the work from the boss end of the large, threaded end. In addition, interposing feeler *J* between the inside of the boss on the work and the shoulder *S* of the gage constitutes a test that is made to insure that the length of the boss is correct. This gaging arrangement accomplishes a good deal in a very efficient and comparatively cheap manner.

High-quality workmanship results from final check-ups by master gages, and such tests are particularly desirable where several jigs are used to handle the same operation on several pieces, due to large production of the same parts.

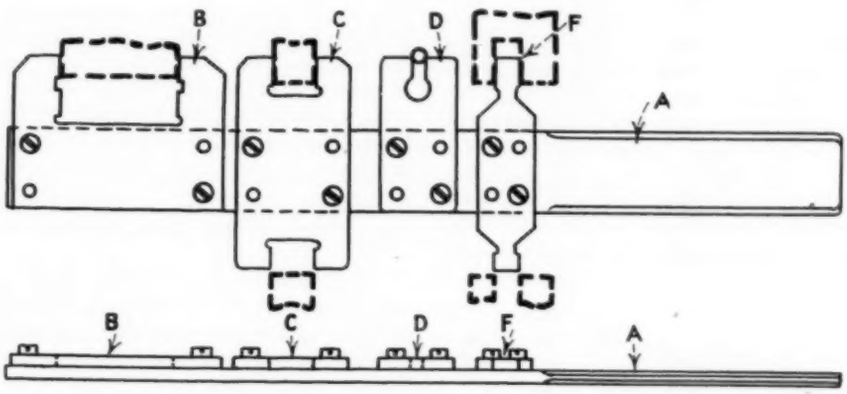


Fig. 3—A simple set-up of gages for checking several successive operations. These gages are mounted on a flat bar. Different combinations of gages can be used

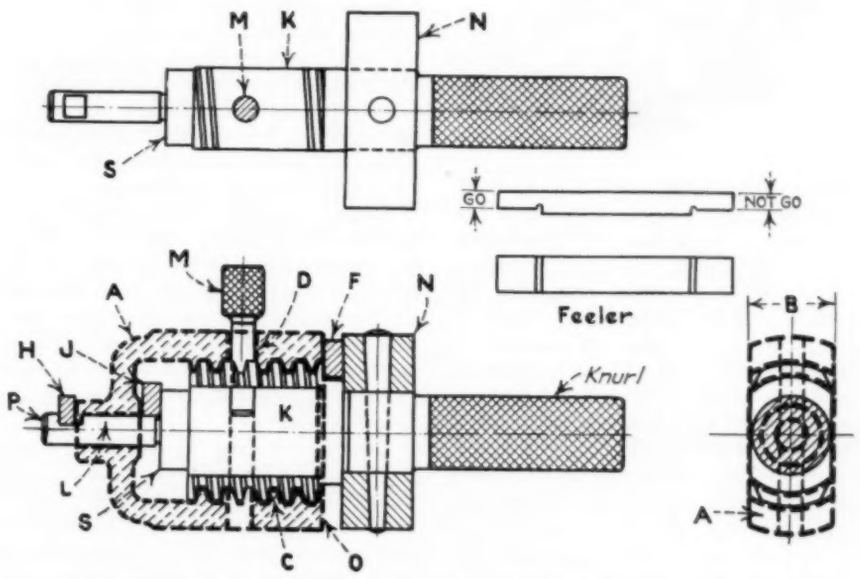


Fig. 4—Work in which points relative to internal threads is sometimes difficult to check, especially where the threaded portion has been flattened on the sides

Two Letters on A Recent Advertisement in American Machinist

To the Editor:

I wish to congratulate you on being able to include in your Searchlight Section the announcement which I noticed recently (*AM*, Vol. 78, page 55). This was an advertisement of a well established eastern firm soliciting applications from men over 40 years of age, well grounded in practical experience.

I should imagine that this firm may recruit some very substantial and valuable men in this way—men who have stood the test of "doing." Surely young college trained men should have a chance, but their sphere of usefulness will not interfere with these men. Also a man of 40 should have from ten to twenty years good service left in him.

I am not speaking from bias for I am both college trained and under 40. I hope your organization may exert its great influence toward utilizing in industry the talents and experience of these practical, middle-aged men who should be now at their best.

—Octave Antonio.

To the Editor:

A most unusual advertisement for foremen appears in (*AM*—Vol. 78, page 55).

I presume you may receive other comments with reference to same. Evidently there still remain managers who are looking for practical men instead of theorists. My principal comment is that it is a most unusual advertisement which will be read with considerable interest by those who particularly favor college men.

—Arthur Wells.

Which Weather Depressions Best— Special Machines or Standard Lines?

HERBERT F. CRAWFORD

One more depression has added its quota to our fund of facts on this important question. But is it safe to predict which policy will be best in the next depression based on our recent experience?

BOY AND MAN, I've been through more business depressions (we used to call them panics) than I care to recall. And, as I think back over the way in which machine builders have come through them, as a whole, it gives food for thought and discussion. It also shows that the old saying of Patrick Henry (or was it?) that "the only way of judging the future is by the past" may not be as good as we used to think.

Most of the old timers in the machine building game will recall how the F. E. Reed Company practically never shut down during panics that closed most other shops. Reed built good engine lathes and managed to get financial backing to carry him through. He stocked engine lathes by hundreds. And when the Russo-Japanese war broke out, for example, he had hundreds all ready to deliver, making a handsome profit. But if we "judged from the past" in such cases today we would find the sheriff waiting at the door some fine morning.

Swing to Single-Purpose

Back in those days the engine lathe was the backbone of every shop, large or small. It was as standard as the older type of milling machines or drill presses. But while we still, and probably always will, have engine lathes, much of the work we used to do on them is now done on hand turrets or semi-automatics and the maker who stocked hundreds of machines of any one kind would have interest charges staring him in the face in no friendly manner.

In contrast with this phase of the machine building game we had a spell of highly specialized, single-purpose machines which greatly reduced labor costs when the quantity was large enough. Such machines could only be stocked in very limited numbers if at all. Now the swing is toward more or less standard machines frequently built up from a variety of more or less standard units. These give more opportunity for building in advance of orders, but there is a limit to the money that can be safely tied up in such parts. And unless there is a sudden demand for large numbers,

making up a large stock simply postpones the day of laying off men or cutting hours. Even here the Reed precedent would hardly be a safe guide.

There is also another phase for the machine builder to consider. Shall he specialize on one kind of machine or have a "line"? In the early days of machine tool shops it was customary to have a "line" as in the case of Brown & Sharpe, Pratt & Whitney, Putnam, Sellers, Bement, Niles and others. Later we evolved the idea of specializing on a single machine, and in extreme cases, in a single size. One enthusiast envisaged the day when one shop would make nothing but 36-in. pulleys and other shops pulleys of other sizes. Acting on his advice a large woodworking shop cut its list of machines from over a hundred to three. And, for a time at least, they made more money than they did with the larger line.

But times changed. The market for the single size of machine became practically filled and other sizes were demanded. So, bowing to conditions and abandoning theory, the one-size advocate enlarged in his line and added a few others. By so doing he has fared better than those who stuck to only one type of machine. In one such case, although the machine was well known and had an excellent reputation, orders were almost minus for nearly two years. Overhead, however, forgot to take a similar holiday.

Don't Forget the Selling

Even these examples do not form an exact guide for all managers of machine building plants. If they decide against a single line it does not tell them how far to extend their output, nor, most important of all, how to select the items to fill out their line. They must not only consider their ability to manufacture at a minimum cost but what is even more important their ability to sell the product. Unless it is used by the same customers as their present machines it means a new selling organization or an expansion of the old into a new field. Neither alternative is entirely pleasant nor is there an assurance that it will be profitable.

So the manager is confronted with several real problems. Shall he enlarge his present line? Shall he add to the types of machines built? How shall he find new machines or accessories that can be sold at a profit? Shall he consider some entirely different line that may have different seasons or cycles than his own?

Perhaps his best course is to study the affairs of concerns with one or more lines during the past four years. And even then he must consider the financial backgrounds and the management of these concerns as well as the number and the variety of their product.

Who wants to be a manager, anyhow?

EDITORIALS

VOLUME 78 AMERICAN MACHINIST NUMBER 19

ESTABLISHED 1877

McGRAW-HILL PUBLISHING COMPANY, INC.

K. H. CONDIT F. H. COLVIN

EDITORS

Gangster Methods

LABOR union leaders have adopted in their "Flying Squadrons" what looks suspiciously like the methods of the gangster. As a tactical weapon the squadron of automobiles and trucks is unquestionably novel and certainly effective, except in such cities as Lawrence where the police were on the job and refused to be intimidated. As a strategic weapon the squadron threatens to be as much of a boomerang as the San Francisco general strike in its ability to arouse public resentment against those who employ it.

There is only one issue, of course, and that is union recognition. Under NRA the textile mill workers have gained an average of seventy-five per cent increase in pay and a reduction in weekly hours from fifty-five to forty. An impartial commission reported some months ago that the industry could stand no further changes under present conditions.

The Administration is in a difficult position. Is it to stand by and permit a racketeering group to foment disorder and force out of employment the seventy-five per cent of textile workers who do not wish to belong to the union but who do want to work? Is it to support the strike organizers by putting those forced out of employment on the relief rolls? If it does not do so how can it justify itself to those unfortunates who have lost their means of livelihood through no fault of their own?

A firm stand against such gangster methods as the use of the "Flying Squadron" is the only attitude that will justify any government—federal, state or municipal.

Seesaw

WHILE the great majority of the voters in the United States welcomed the early endeavors of the Roosevelt Administration to stimulate recovery, and withheld criticisim of some of the more unprecedented moves made by it, it is becoming painfully apparent that the total result is much like the performance of the children's seesaw. In its attempt to restore the balance destroyed by depression the Administration has evidently piled too much on the high end of the plank and the situation is little better than it was before, as that end has become the low one. There was probably a brief period when an approximate balance existed, but the Rooseveltian zeal for drastic reform soon upset it.

The latest and most disturbing evidence that the balance is not likely to be restored by political means is the announcement of the resignation of Budget Director Douglas, who has been looked upon by many as the sanest of the few economically orthodox members of the Roosevelt organization. Possibly Mr. Douglas was unable to accept the Richberg report, and said so. At any rate, his departure from official Washington will not help the standing of the Administration in industrial circles.

As for the Richberg report, we are willing to accept his figures on the gains made since March, 1933. So far as we know no one has any better ones. But when it comes to attributing all the gains to the New Deal, as Mr. Richberg does so blithely, we cannot follow his reasoning. A certain amount of recovery was unquestionably caused by the return of hope which followed the President's first firm actions. But a continuing industrial recovery depends more on confidence than on any other single factor, and so long as Mr. Roosevelt maintains his policy of concealing his objectives, there can be no great revival of the confidence that leads to the taking of economic risks. Without that kind of confidence recovery will be slow, purchases of capital goods will be limited to the unavoidable replacements of worn-out, broken-down units, and employment in the machinery industries will lag far behind the rest of industry.

Such recovery as we have had would probably have come about if there had been no New Deal with all its confusing side issues. This point is debatable, of course, but we hold that the effect of politics on economic welfare is not as vital as the political partisans would have us believe. We should not be too disturbed, therefore, at the implications of the Lewis withdrawal. The immediate effect may well be adverse, but in the long run the political seesaw will flop from side to side, first helping, then hindering, and business and industry will continue to reflect economic influences rather than political ones.

Decline of Piece Work

ACCORDING to advices from the motor city there is a tendency to abandon piece work in favor of straight hourly wages. This seems a logical trend in view of the large extent to which progressive machining and assembling operations are used in this industry. The speed of the men is set by the timing of

operations on the machines and an extra fast man in a line can add nothing to the output of the department. The rate of production is in reality set by the slowest man in the line as the machine rate must be set by him. Naturally production men strive to have the slowest man as fast as possible.

In some cases of this kind group bonus has been found advantageous. With proper administration the various members of the group help each other so as to increase output and earn as much bonus as possible. Where the foreman shares in the bonus, as in the Gantt system, he has an incentive to instruct the slower or less skilled members of the group and so add to the earnings of all.

Need for Standards

THERE ARE encouraging signs of increasing interest in the adoption of uniform standards of both fits and finishes. Companies that have grown large through expansion of their business into different lines are beginning to realize the discrepancies between the different departments of their own organization and to change such conditions. It is also encouraging to know that before making such changes these companies are seeking information as to the existence of national standards and the possibility of using them in their own work.

This awakening of interest in standardization is particularly gratifying to those who have given years to the furtherance of such standards. It indicates the foresight of those who saw not only the need for such a body as the American Standards Association, but worked until it became a reality. Added interest by live manufacturing concerns will speed the work and add greatly to its scope and value.

.CHIPS.

Washington—With Election Day less than two months away, Maine gives a preliminary popular appraisal of the New Deal . . . Herbert Hoover in a magazine article attacks the New Deal as a challenge to liberty . . . Jouett Shouse, former Democratic campaign chairman, is elected president of the newly formed American Liberty League . . . Meanwhile the A.A.A., taking its critics seriously, proposes to poll the farmers on the future of its crop control program . . . President Roosevelt confers with Coordinator Eastman on broader powers for the I.C.C. and with Gubernatorial Candidate Upton Sinclair on everything but politics . . . But the ex-Socialistic aspirant seemed elated at the interview . . . Secretary Perkins joins other Administration spokesmen in denying malice toward the "profit motive" . . . Budget Director Lewis Douglas resigns, after long disagreement with the Federal spending program . . . W. R. Stark, "last of the conservatives," quits the Treasury Department . . . Inner workings of the international submarine business are bared by Senate investigation . . . Fuel code authority resigns in a body as a protest against NRA vacillation.

Foreign—League of Nations Council, reconvening at Geneva, faces Saar, Chaco and other major problems . . . France and Italy reach closer accord as Mussolini hints independence of Teuton criticism . . . Il Duce reported ready to remove women from industry to build population and relieve unemployment . . . British trade unionists reverse stand formely taken for anti-war strikes . . . Sir Josiah Stamp, British banker, industralist and economist, recommends curbs on invention to protect industry and labor . . . England said to seek extension of naval agreement along present lines . . . Japan to demand parity . . . Sessions on Soviet debt settlement reach stalemate.

Finance—Banks' stand on limiting industrial loans upheld by RFC Head Jesse Jones . . . Dollar strengthens against franc and pound as the Treasury refinancing date approaches . . . Railroads earn at the rate of 1.99 per cent of investment in seven months as compared to a 1.66 per cent rate for the same period last year . . . Secretary Morgenthau gives terms of Treasury refinancing.

Industry—President appoints board of three to mediate textile strike as blood is shed in southern mills . . . "Flying squadrons" and other labor tactics are termed as a "challenge to the nation" by mill owners . . . Garment workers are scheduled to walk out October 1 . . . Aluminum strike ends after month's tie-up . . . Matthew Woll, A. F. of L. vice-president, urges that capital and labor unite to thwart Communistic influence . . . But President William Green, of the same organization, states that the 30-hour week is vital . . . As of August 1 Class I railroads have on order 13,755 freight cars, 35 steam locomotives and 107 electric locomotives . . . Steel industry announces 10 per cent salary cut as Ford announces plan to spend $12,000,000 to bring his own mill capacity to supply 3,000 cars per day . . . Fred J. and Charles T. Fisher leave the General Motors Corporation . . . R. H. Faulkner returns to Auburn as president, and reports of merger with Pierce-Arrow are renewed.

Indicators—July exports at 161,786,571 fell below the June figure but are above July, 1933 . . . *Business Week* index falls to 57.5 for the year's low . . . Carloadings, advancing for the week, are still under last year . . . Electric power consumption falls below both preceding week and the corresponding week a year ago.

Cuban Trade Agreement Gives U.S. Machinery Greater Preference

Signed on August 24 and effective September 3, the new reciprocal trade agreement between Cuba and the United States will hold for three years unless terminated by special agreement. Thereafter it will remain in effect automatically unless cancelled by either country upon six months' notice.

In the large list of items, scheduled for exclusive and preferential customs treatment between the two countries, are included various classes of industrial machinery and agricultural implements. On most of these items the margin of preference given Cuban imports from the United States has been increased.

The accompanying list shows the new and old ad valorem rates and margins of preference. The rates given are in all cases the general rates of the Cuban tariff reduced by the percentages of preference shown and thus constitute the basic duties applying to the U. S.

The former differences in rates of duty, depending upon whether or not copper or its alloys predominated, have been entirely abolished. The two rates of duty appearing in the "old rate" column and the two percentages of preference in the "margin of preference" column refer to the former differences in duty based on the predominance of copper.

Each of the nations has agreed not to increase federal internal taxes nor to impose new taxes on the items which have been tabulated. Also, effective July 1, 1935, the two countries have agreed not to impose any fees for the consular certification of any shipment in excess of two per cent of the value of the goods, f.o.b. port of exportation. The present Cuban consular certification is five per cent.

In addition the United States and Cuba have agreed that no quantitative restrictions shall be imposed on articles imported from the other except for the special arrangements on sugar and tobacco.

The trend of the United States trade with Cuba in industrial machinery and agricultural implements follows:

Cuban Tariffs on Machinery and Agricultural Implements

Merchandise	Rate to U. S. Ad Valorem New	Rate to U. S. Ad Valorem Old	Margin of Preference to U. S. Percentage New	Margin of Preference to U. S. Percentage Old
Machinery or apparatus for manufacturing or refining sugar or alcohol, including loose parts and accessories	7.98	8 & 9	30	20 & 25
Machinery, apparatus and implements, for agricultural pursuits and labor, including loose parts and accessories	6	6 & 7.5	25	20 & 25
Portable or fixed machinery, apparatus or instruments for the industries in general including those used in aqueducts, including loose parts and accessories	7.98	8 & 9	30	20 & 25
Thermometers, manometers, pyrometers, pressure gauges, carbon dioxide gauges, and vacuum gauges, etc. for use in connection with machinery and apparatus	10.5	Various	30	Various
Motors of all kinds, including windmills, and loose parts and accessories	7.98	8 & 9	30	20 & 25
Pumps of all kinds, including loose parts and accessories	7.98	8 & 9	30	20 & 25
Steam generating boilers of iron and steel, of all kinds, and parts and accessories including tubes, whether or not cut to measure	14	16	30	20
"Fluses" (special tubing for boilers with flanges on one or both ends) and completely finished loose parts and accessories for boilers of copper or its alloys	17.5	18.75	30	25
Turntables and cranes, including loose parts and accessories	15.96	16 & 18.75	30	20 & 25
Cane loaders, with or without scales including loose parts and accessories	24	24	20	20
Machines for sewing, embroidering, spinning and weaving, etc., and loose parts and accessories	4	4 & 7.5	20	20 & 25
Non-specified machinery and apparatus, not for industrial uses, including loose parts and accessories	15.96	16 & 18.75	30	20 & 25
Tractors	4	4	20	20
Loose parts and accessories for tractors	4	4	20	20
Mine cars	12	12	20	20
Dredges, scows, floating water tanks, and other similar apparatus not for navigation, with or without motors	12	12	20	20

United States Exports to Cuba

	Industrial Machinery	Agricultural Machinery and Implements
1924	$10,348,980	$1,519,123
1925	11,618,215	891,769
1926	6,631,961	671,258
1927	8,886,290	980,698
1928	5,852,405	812,367
1929	5,143,240	1,161,123
1930	2,715,651	561,403
1931	1,394,214	242,441
1932	662,560	52,287
1933	471,399	86,075

Air Corps Seeks PWA Funds for Modernization

With requirements totaling $2,309,685, the Army Air Corps has prepared a list of capital goods items needed for the coming year. The Air Corps is going to seek the necessary money from the Public Works Administration.

The list is divided into three tabulations, the first of which indicates items required by depots as original equipment or for replacement of worn-out items. This category, totaling $1,225,950, is made up chiefly of machine tools and other maintenance equipment.

The second tabulation indicates requirements for equipment of major stations, practically all of which is original equipment. This section, which comes to $233,735, also consists largely of machine tools.

In the third tabulation are the requirements of depots and stations for hangar and airdrome equipment which does not fall strictly within the category of machinery. These items, which are chiefly tractors, trucks and trailers, total $850,000.

Linde Air Products Announces Welding Clinic

In a three-day session, starting September 27, the Linde Air Products Co. will hold a clinic at Cleveland, Ohio, to pass on to those interested in oxy-acetylene welding and cutting the new developments in that field. No fees will be charged, and an attempt will be made to accomplish for this process what has been done for the medical and other professions through clinics.

Program Announced for Annual Safety Congress

Totalling 120 sessions and more than 350 speakers, the official program has recently been announced by the National Safety Council for its 23rd Annual Congress and Exposition to be held in Cleveland, Ohio, October 1-5. In addition, sessions have been planned for school executives, street traffic authorities and those interested in safety in the home. In order to complete this comprehensive program in the short space of five days, it will be necessary at times to run as many as fourteen sessions concurrently.

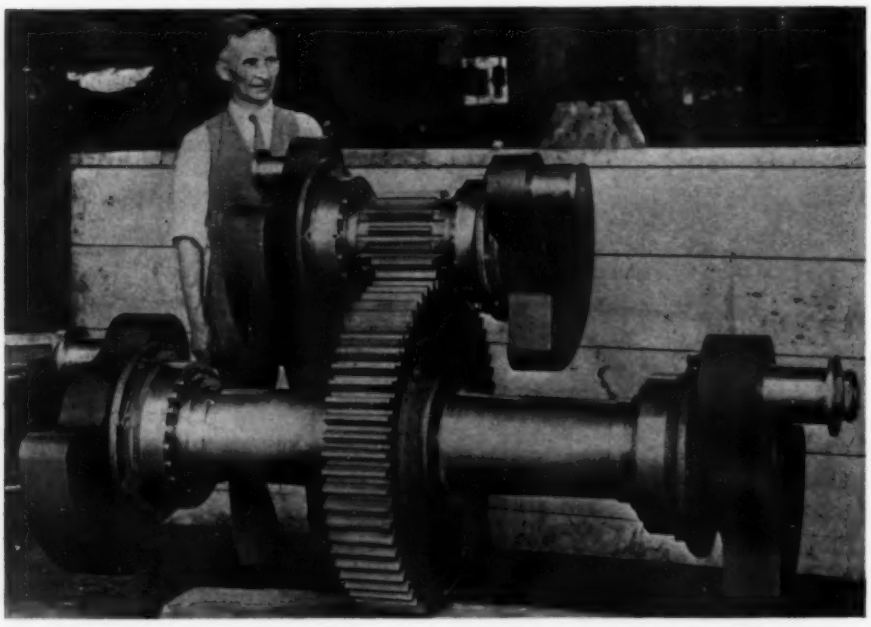
An outstanding feature of the meeting this year is a series of subject sessions planned and sponsored by the American Society of Safety Engineers, engineering section of the National Safety Council. These include "Fusion Welding and Cutting," "Mechanical Methods of Handling Materials," "Safe Use of Electricity in Industry," "New Workers," "Safe Use of Chemicals in Industry," "Dust in Industry," and "Why People Fall."

A safety town will be set up in the main ballroom of the Statler Hotel to show scores of interesting and educational exhibits of industrial safety equipment. A public safety equipment exhibit, featuring traffic control equipment will be held in the Cleveland Hotel.

Included in the program offered by the power press section of the National Safety Council are the following addresses:

"Our Section—Its Past, Present and Future," General Chairman A. L. Kaems, Simmons Co.; "Trend of Accidents in the Power Press Section," J. D. Lyle, personnel director, Fisher Body, Cleveland Division, General Motors Corporation; "Training the New Power Press Operator," Harry L. Sain, special representative, Industrial Commission of Ohio; "Handling and Piling Sheet Metal," G. S. Thompson, Gnau & Co.; "Methods Other than Commercial Safety Devices for Preventing Power Press Accidents," speaker to be announced; "Supervision and its Relation to Accidents," A. D. Byler, vice-president and general manager, Edison General Electric Appliance Co.; "Punch Press and Drop Forge Safeguards: (a) Drop Forge Operations," E. J. Wallman, safety engineer, Great Lakes Forge Co., "(b) Heavy and Light Press Operations," G. F. Oliver, factory manager, J. W. Murray Mfg. Co., division of The Murray Body Corporation of America; "Typical Accidents in Our Plant and the Lessons Gained," S. H. Slaymaker, safety director, Fairbanks, Morse & Co.

Some 6,000 to 8,000 delegates are expected to meet in Cleveland for the Safety Congress.



***Gears for a Fireless Locomotive*—Quite operation is achieved by the use of hardened and ground alloy steel gears and Timken roller bearings in the new 50-ton locomotive purchased by the Brooklyn Navy Yard from the H. K. Porter Co. The frame and all parts possible have been machined from rolled steel slabs. Steam is supplied from a stationary boiler plant at 200 lb. pressure and 125 deg. of superheat**

Dr. Sauveur To Be Honored at Metal Congress

At a recent meeting the trustees of the American Society for Metals voted to establish an achievement medal for the recognition of advances in metallurgical knowledge. Because of Dr. Albert Sauveur's eminent contribution to the science of metallurgy, it was voted that the medal be named in his honor and henceforth be known as the Albert Sauveur Achievement Medal.

As a fitting tribute to Dr. Sauveur, who is now Gordon McKay professor of mining and metallurgy at Harvard University, he will receive the first achievement medal at the annual banquet of the society to be held at Hotel Pennsylvania, in New York City, on Thursday evening, October 4.

German Machinery Imports Rise in First Half

Despite severe restrictions against its importation, Germany's purchases of foreign machinery during the first half of 1934 were greater than during the corresponding periods of either 1932 or 1933, according to the Department of Commerce. On the other hand, German machinery exports during the first six months were lower than for the two preceding years. Imports of machinery into Germany from January to June totaled 11,290 metric tons, valued at 25,479,000 reichsmarks, contrasted with 8,767 metric tons, valued at 21,749,000 reichsmarks in the first half of 1933 and 8,771 metric tons valued at 23,999,000 reichsmarks in the first half of 1932.

Metal-working machinery, prime movers, pumps, compressors, fans and blowers, and crushing and ore processing equipment accounted for the increases in machinery imports during 1934. The greatest increase was in prime movers, which amounted to 2,727 metric tons, valued at 7,316,000 reichsmarks as compared to 843 metric tons, valued at 2,680,000 reichsmarks during the corresponding period of 1933.

Exports of machinery from Germany in the first half of 1934 amounted to 142,283 metric tons, valued at 228,852,000 reichsmarks, compared to 156,922 tons valued at 281,666,000 reichsmarks in the like period of 1933, and 246,940 tons valued at 428,739,000 reichsmarks for the first six months of 1932.

Auto Production Drops Further As First 1935 Models Appear

DETROIT—Automobile production is operating on a downward trend each week. Output the week ending September 1 was only slightly above that of July 7 which included shut-downs over the Fourth. With Ford and Olds closed, Chevrolet dropping from 3,000 to 2,000 and Plymouth increasing its schedule somewhat, a decrease of roughly 19,000 cars over the week of August 25th is recorded. August output was slightly below the 238,934 produced last year and about 15 per cent below that of July.

However, both output and sales have been maintained well above seasonal expectations. Registrations for the first seven months of this year show an increase of 40 per cent over the same period last year.

With production following sales closely, September business is problematical. This close relationship is shown by Pontiac's experience in which the schedule for July, August and September has been stepped-up four times since July 1 to a total of 7,800 units above earlier expectations.

Federal expenditures and an expected acceleration in British imports due to tax reductions, and fall in the value of the dollar are favorable influences to Fall sales. In addition an intensive sales campaign is being projected by manufacturers.

The amount of pattern, tool and die work let outside Detroit remains in controversy. Representatives of outside firms are soliciting pattern work while pattern departments of automotive plants are being opened, according to the Pattern Manufacturers' Association. Meanwhile, 32 pattern shops, closed the past month by the strike, opened September 4 with the controversy unsettled. It is claimed that some castings are being placed outside the city and with them the necessary tool work. Tool concerns in small towns are reporting increases in inquiries and releases to design beginning the last week in August.

The unusually well-maintained sales of automobiles this year to date have unquestionably delayed new model introduction. The total tooling programs on new models are not likely to be as extensive as anticipated because of the reworking of many dies and the comparatively few changes to be made in some quarters. Some decrease in buying in the castings field is reported within the last two weeks, while an authoritative source states that the amount of pattern work available at present to be let is small. This presages a late introduction of new models generally. New models will wait until consumer demand drops to the point where production of current designs are no longer profitable.

The trend toward the pressing of larger body sections, evident in the past, will be accelerated this year from present indications.

An uncertain and retarding influence on the industry was removed September 1 by extending the Automobile Manufacturers' code for sixty days. The merit clause and the maximum of 48 and average of 40 hours per week over the year were retained. Because of the set-up under the President's agreement of last March, collective bargaining was not an issue though both the merit and hour clauses were opposed by labor. The automotive equipment code, unless amended, does not expire until June 1935.

The curtain on 1935 models was raised by Packard August 30 when its three new lines were shown to dealers. Two eights of 130 and 150 and a twelve of 175 horsepower in a variety of body styles constitute the line. The main features are component stream lining and the use of an improved bearing material, of bronze impregnated with lead, developed in conjunction with the Allison Engineering Co. and manufactured by the AC Spark Plug Co.

The smaller model, announced as in preparation some time ago is not to be ready for several weeks. While this venture into the medium price field is for the purpose of using facilities to better advantages, the expectation is that the new large car models will reverse the downward trend of the high-priced car caused by the depression and the operation of the retail code. Packard's announcement was quickly followed by the introduction of the new Auburn line.

Aluminum connecting rods and bearing materials are new features being considered in improving engine performance.

The acquisition of the Detroit Vapor Stove Co. by Borg-Warner gives this company a new unit in addition to the automotive parts and refrigerator business.

• INDUSTRIAL REVIEW •

• Although disappointments have been numerous in machinery and machine tool trade circles, some of the important centers report a more optimistic attitude. The holding up of several important equipment buying programs has been a severe blow, and the general business uncertainty which is attributed to the opportunistic policies of the Administration and NRA is acting as a brake on other contemplated developments. Some members of the trade feel that no fall boom is likely to occur, others that it may come along in October or November.

• Business in the East is almost at a standstill. New England industrialists are outspokenly opposed to New Deal policies and are not making commitments until they see more reassuring signs. New York and Philadelphia business is very dull and likely to remain so until the labor and political disturbances settle down. Pittsburgh reports a few more inquiries but no increase in orders, and not a very bright outlook for the autumn.

• Cleveland reports that Northern Ohio business has been dropping steadily for some weeks but that payrolls of smaller companies have started to increase, which is taken as a favorable omen. Inquiries are fairly brisk, orders few. In Detroit, the past week saw substantial inquiries for special machinery from three of the automobile companies, and tool and die shops are busier. More equipment releases in connection with new models are expected soon. Cincinnati is not looking for much business in September. Inquiries are somewhat better but orders have not improved. A few used machines have been sold. Indianapolis reports fair inquiries and occasional orders.

• Several Chicago machinery distributors have had encouraging business in the last few weeks. The number of active inquiries out is leading to an optimistic view of the last quarter. Things continue very slow in St. Louis although there are a few possibilities that may develop into orders. Milwaukee reports continued dull business and threats of labor trouble. Machine tool companies are expecting automobile business before many weeks.

R. E. W. Harrison Announces Machine Production Study

WASHINGTON—Will the output of American concerns manufacturing machinery increase in line with a gradual upward trend starting at the comparatively low level at which production now stands, or, as a result of new mechanical developments in such fields as television, aircraft, air-conditioning and prefabricated houses, will it rapidly expand until it regains predepression levels, and from his higher point continue the upward trend begun in 1922? This question, the answer to which may involve the financial and productive readjustment of many machinery fabricating firms, is the topic for a study now being launched by experts in the Machinery Division, Bureau of Foreign and Domestic Commerce, according to a recent announcement by R. E. W. Harrison, chief of the division.

"If American machinery production, which has been increasing at a comparatively steady pace since the first quarter of 1933, when it reached its lowest level since 1910," Mr. Harrison said, "continues to rise at the same rate, the companies which are engaged in the manufacture of machinery must adjust not only their productive capacity but also their financial organization—their corporate and bonded indebtedness—to the new and reduced levels, since they are now established and geared to operate at the rate of their former production of 1928 and 1929. If, on the other hand, production of machinery resumes the level of these years within a comparatively short time, no wide-spread productive and financial reorganization are necessary. The study about to be undertaken by the Machinery Division should throw light on future trends and clarify this situation, which is of vital importance to American producers of mechanical appliances. The answer to the question will consist in a careful appraisal of the probable markets and extent of general usage which new and improved mechanical equipment will find."

Recalling the effect which the development of the automobile and of improved farm and industrial machinery had in increasing production in the past decade, Mr. Harrison stated that the study now being initiated would attempt to evaluate the possibilities of accomplishing similar results from other mechanical products.

In addition to statistics of domestic production of machinery which are not complete, Mr. Harrison used precise figures of machinery exports as a fair indication of production. They demonstrate that machinery fabrication has increased steadily from 1922 to 1929 on a uniform trend and then declined until 1933. Since the Spring of that year production has resumed the upward movement. From a monthly average value of nine million dollars in 1922, exports increased to a point of twenty-one million dollars in 1929, an average increase of $1,200,000 annually. In May, 1933, at a figure of three million dollars, exports again increased until the value for May, 1934, is seven million dollars.

Prior to the completion of the investigation, Mr. Harrison refrained from making prognostications as to the effect of new fields of machine development but he implied that innovations of the last few years held promise of rapid expansion. Among these are air-conditioning, which is gaining increased favor and which has been most successfully developed in the United States. Other promising items are safer and more efficient aircraft at a low price range conducive of wide usage, and perfections of diesel and electric locomotives and stream-lined engines and cars. Inexpensive agricultural equipment for installation on small farms, the practicability of which has already been demonstrated, was also held to invite other wide markets.

Other fields for mechanical development may be found in cheap housing, in prefabricated steel homes, television, less expensive laundry equipment and improved medical and surgical appliances made available at a volume and price which will greatly expand their usage. Indirect aids to increased machinery production and utilization are to be seen in the facilities of roads, bridges and power plants which have been and are being constructed on a vast scale by public works projects in all but about three counties throughout continental United States, and in the advantages of cheaper and more abundant power resulting from Federal programs, such as the Tennessee Valley developments.

Metal-Working Code Hearings Scheduled

Date	Place	Deputy Administrator	Association
Sept. 18	Commerce Bldg.	J. G. Colwing	National Electrical Manufacturers Association
Sept. 19	Commerce Bldg.	W. W. Rose	Cast Iron Oil Pipe (application for exemption)
Sept. 19	Commerce Bldg.	B. S. King	National Association of Pipe Nipple Manufacturers (budget and exemption)

Farm Equipment Exports Dip in July

Although considerably above the same month of last year, July exports of agricultural equipment dropped somewhat below the June total. Foreign shipments in this group were valued at $1,993,300 for July, $2,159,122 for June and $1,053,095 for July 1933.

Tractors made up the bulk of July shipments, with a value of $1,154,139 as against $536,301 for July 1933. Both wheel and tracklaying tractors contributed to the gain, the former amounting to 488 units, valued at $357,915 and the latter to 243 units, valued at $464,802.

Shipments of tillage implements more than doubled in July as compared with a year ago, the respective values being $215,674 and $102,191. Because of reduced shipments of grain harvesters and binders, and parts and accessories for harvesting equipment, this group recorded a decline of about 10 per cent from July 1933, with a total of $206,082, compared to $230,660 last year.

N.R.A. Makes Appointments to Metal-Working Code Authorities

Among the recent appointees to act as administration members without vote on the code authorities of industries in the metal working field, are the following:

Hoisting engine manufacturing and hoist builders industries—Charles A. Brantingham, of Thompson & Lichtner Co., engineers.

Railway appliance manufacturing and conveyor and material preparation equipment industries—J. E. O'Brien, formerly of the Missouri Pacific Railway.

Kiln, cooler and dryer manufacturing and mechanical press manufacturing industries—George H. Charls, former assistant to the president of the American Iron and Steel Institute.

Business furniture, storage equipment and filing supply and slide fastener industries—J. G. Ainslie, district sales manager, Realty Bond & Mortgage Co.

Boat building and boat repairing industry—Herbert G. Cook.

Commercial vehicle body industry—Howard B. Hall, automotive engineer.

Cotton ginning machinery manufacturing industry—Harry A. Mitchell, professor of marketing, Tulane University.

Power and gang lawn mower manufacturing industry—Elmer M. Naylor, vice-president, Naylor Pipe Co.

Hand bag frame manufacturing industry—R. P. Barry, formerly private secretary to Stuyvesant Fish.

Administration Organizes for New Phase of New Deal

WASHINGTON—Another election day approaches in a period of waning enthusiasm for the recovery efforts of the New Deal. Even the "forgotten men," recruited chiefly from the farm and the ranks of labor, are far from satisfied with the extraordinary legislation and administrative dictums rendered in their behalf. Business leadership, always lukewarm to the current federal experiments, has grown still more skeptical. Crystallized opposition is indicated by the formation of the American Liberty League, the forthcoming book by Herbert Hoover and by the statements of men like Owen D. Young and Bainbridge Colby, formerly prominent in the Democratic ranks.

There is no doubt that the President is approaching a period in his administration when his mettle will be tested. He will be watched closely to see if he maintains his wonderful poise when things begin to go against him.

Meanwhile the New Dealers are striking back at their critics. Secretary Wallace's suggestion for a farm poll on the A.A.A. crop curtailment programs, to "let the farmer decide," indicates that the unkind remarks about the "business of not raising hogs" have been read and resented. Donald Richberg's reports attempt to confound those who would cast aspersions on the Blue Eagle. But, as the persistent critics point out, the figures quoted in these reports while not inaccurate, are hand-picked, particularly in regard to date in order to prove a favorable premise. They ask pointedly why the vaunted accomplishments of NRA have failed to bring business above the level of a year ago.

Strikes continue to constitute a major menace to the recovery program. The idleness of some 350,000 textile workers sharply interrupts the increase in purchasing power so sanguinely sought. In the opinion of many, however, a major showdown was needed to clarify the entire labor situation.

Meanwhile, plans for simplification of NRA and the consolidation of all industry into 22 code groupings is progressing. It has long been evident that the complex structure and multiplicity of governing bodies originally projected would prove too expensive and too cumbersome to be effective.

If food prices advance sharply, as Secretary Wallace admits, the Administration will have a consumer protest to face. From past records it may be proved that the public does not look at the price level as a whole. Sentiment is adversely aroused by rising prices in a few widely used commodities. In the past skyrocketing food prices led to riots even when there was no one to blame. At present, however, A.A.A. is particularly vulnerable to attack on this score.

Attempts to turn the downward trend of business are still being made along the lines of credit inflation which according to the predictions of Major Angas should soon take hold. Washington observers feel that, unless this course is effective soon, currency inflation is still a strong possibility.

Despite the approval given the cautious banker, as regards industrial loans, by Jesse Jones, R.F.C. chairman, these loans are being made in increasing volume. Advances have been made to firms in the field of coal mining, contracting, stone quarrying, oil refining, fish canning, baking, brewing, and the manufacture of cartons, machine tools, furniture, refrigeration, silk, tableware, felt, washing machines and auto accessories by the R.F.C. These loans have stimulated similar advances by private bankers since credit will not be extended by the government unless the applicant can establish that money could not be obtained from regular commercial sources. This means that the judgment of the banker in his community is reviewed by federal examiners. It is estimated that the R.F.C. has passed the $12,000,000 mark in industrial loans while the Reserve Bank total is close to $8,000,000. Congress at its next session will be asked to increase the limits now set on the total that may be loaned to industry.

Determined opposition to R.F.C. loans for plants that have fallen by the economic wayside is being registered by business. The Federal Emergency Relief Administration has offered in one instance at least to guarantee a loan to a closed manufacturing plant in order to provide a work relief project that may be self-sustaining. Plants that have been able to keep operating during the depression claim this is unfair.

There can be no question that the Federal Reserve system is in danger. The left wingers want more than a government controlled institution as a present. They want a Treasury controlled institution while a middle-of-the-road group want a federal monetary authority that would simply by the Federal Reserve Board under another name.

"The last anchor to the windward is gone" sums up the comment in Washington of the friends and opponents of the New Deal alike, except the left wing element, regarding the resignation of Lewis Douglas as budget director. Douglas is regarded as the most serious loss the administration has suffered since Senator Glass.

Col. Robert W. Lea, assistant NRA administrator, has also resigned. Major Phillip B. Fleming has been appointed acting deputy administrator for the Public Works Administration.

• OBITUARIES •

MICHAEL H. BRODERICK, proprietor of the Broderick Co., manufacturers of locomotive-type boilers, and of the Dean Forge Co., Muncie, Ind., died at the age of 64.

ALFRED B. HICKEN, president of the Highway Machinery Co., died Sept. 1 at the age of 50.

HARRY F. HOLSCLAW, 46, vice-president of Holsclaw Bros., Inc., Evansville, Ind., tool and die manufacturers, died recently.

HUBERT M. GREIST, president and general manager of the Greist Manufacturing Co., New Haven, Conn., metal specialties, screw machine products and metal stampings, died August 29 of a heart attack. He was 49. He joined the company, founded by his father, in 1905.

COLE STICKLE, 77, president and general manager of the Stickle Steam Specialties Co., Indianapolis, is dead at 77.

• PERSONALS •

C. J. BIANCHI has been elected president of the S-B Gear Corp., 640 West 58th St., New York, N. Y., a company manufacturing and selling speed reducers.

JOSEPH F. GEERS, president of the Index Machinery Corp., Cincinnati, sailed on September 4 for the Far East, where he will visit Japan, China and Manchukuo to establish dealer representation.

S. C. STAMPLEMAN, formerly executive vice-president of the Gillette Safety Razor Co., South Boston, Mass., has been elected president to succeed GERARD B. LAMBERT, who becomes chairman of the executive committee.

L. S. STEPHENS has been elected president of the Stephens-Adamson Mfg. Co., Aurora, Ill., conveyor manufacturers, to succeed D. B. PIERSON, who was made chairman of the board. Mr. Stephens joined the company in 1914, was made superintendent in 1921 and was elected vice-president in charge of production in 1926.

• EXPORT • OPPORTUNITIES

Alfred Herbert (India) Ltd., 13/3, Strand Road, Post Office Box No. 681, Calcutta, India, wants to get in touch with manufacturers of machines for making the metal portions of cornets and other similar musical instruments.

Ing. M. Kocian & G. Nedela, Praha-Vinohrady, Sazayska 32, V Praze, Czechoslovakia, wants to purchase dynamometers for the measurement of resiliency or tension around the circumference of piston rings. The instruments should have capacity up to 300mm. or 11⅞ in. in diameter.

*7728 ● The Hague, Netherlands. Automotive valve-grinding lathes.

*7732 ● Vancouver, Canada. Mucking machines, small size, electric or compressed air drive, for use in mines.

*7730 ● San Jose, Costa Rica. Shoe-sole cementing machinery.

*7706 ● Prague, Czechoslovakia. Machinery for knitting needles and sinkers.

*7705 ● Rizal, P. I. Placer-mining equipment.

*Interested American firms and individuals may obtain the names and addresses of the foreign firms making these inquiries upon application to the Bureau of Foreign and Domestic Commerce, U. S. Department of Commerce, Washington, or any district or cooperative office.

• BUSINESS ITEMS •

The Chicago Pneumatic Tool Company has changed the address of its Birmingham, Ala. office to 211 South 20th St. W. S. LYNCH is manager.

On September 1 the Union Switch & Signal Co., Pittsburgh, discontinued its commercial drop forge business and transferred all dies and unfilled orders to The Champion Machine & Forging Co., of Cleveland. FINLEY L. WALTON, who has directed commercial drop forge sales for the former company, has now become affiliated with Champion in a similar capacity.

The Allsteel Press Co., Inc., 12015 South Peoria St., Chicago, Ill., manufacturers of "Verson" Allsteel punch presses and sheet metal working machinery, has appointed L. RAY PHIPPS, 918 Lapeer St., Flint, Mich., as representative in Flint, Lansing, Saginaw and Bay City.

The Hauck Mfg. Co., Brooklyn, N. Y., recently purchased the assets and good will of the oil burner division, Mead-Morrison Mfg. Co., Boston, and will continue manufacture and stock spare parts for portable rivet heating forges and hand torches.

• MEETINGS •

AMERICAN SOCIETY FOR METALS. Annual meeting, Oct. 1-5. Hotel Pennsylvania, N. Y. W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland, Ohio.

AMERICAN WELDING SOCIETY. Annual meeting, Oct. 1-5. Hotel New Yorker, New York City. Miss M. M. Kelly, Secretary, 29 West 39th Street, New York, N. Y.

NATIONAL INDUSTRIAL ADVERTISERS ASSOCIATION, National conference and convention, September 20-22. Netherlands-Plaza Hotel, Cincinnati. For information address Publicity Headquarters, N.I.A.A. Convention, c/o Union Gas & Electric Co., Publicity Dept., Cincinnati, Ohio.

NATIONAL METAL CONGRESS. Exhibition and program sponsored by the A.S.M., the A.W.S., the Institute of Metals, and Iron & Steel Divisions of American Institute of Mining and Metallurgical Engineers and the Wire Association, October 1-5. W. H. Eisenman, director, 7016 Euclid Ave., Cleveland, Ohio.

NATIONAL SAFETY COUNCIL. Twenty-third annual safety congress and exposition. Oct 1-5. Hotel Statler, Cleveland, Ohio. National Safety Council, Inc., 20 North Wacker Drive, Chicago, Ill.

SOCIETY OF AUTOMOTIVE ENGINEERS. National production meeting, Oct. 11-12. Book-Cadillac Hotel, Detroit, John A. C. Warner, manager, 29 West 39th St., New York, N. Y.

• PATENTS •

AUGUST 7, 1934

Metal-Working Machinery

Apparatus for Fusing and Spraying Substances. Charles Boyden, Los Angeles, Calif., assigned to Metallizing Co. of America, Inc. Patent 1,968,815.

Apparatus for Cutting Metal. Carl M. Yoder, Lakewood, Ohio, assigned to Harvey O. Yoder. Patent 1,968,865.

Header or Upsetting Machine. Richard Lester Wilcox, Waterbury, Conn., assigned to The Waterbury Farrel Foundry & Machine Co. Patent 1,968,921.

Hammer Operating with a Variation in Atmospheric Pressure. Charles Schatt, Brussels, Belgium. Patent 1,968,962.

Hydraulically Indexed Machine Tool. Raymond A. Carlson, Rockford, Ill., assigned to Rockford Drilling Machine Co. Patent 1,968,990.

Grinding Machine. Hans Ernst and Herman R. Isler, Cincinnati, Ohio, assigned to Cincinnati Grinders Incorporated. Patent 1,969,063.

Automatic Milling Machine. Lester F. Nenninger and Fred A. Hassman, Cincinnati, Ohio, assigned to the Cincinnati Milling Machine Co. Patent 1,969,231.

Forging Machine. Hans Muller, Hagen, Germany. Patent 1,969,317.

Arbor Support for Milling Machines. Joseph B. Armitage, Wauwatosa, Wis., assigned to Kearney & Trecker Corp. Patent 1,969,392.

Milling Machine Transmission and Control. Joseph B. Armitage, Wauwatosa, Wis., assigned to Kearney & Trecker Corp. Patent 1,969,393.

Contour Copying Machine. Frederick Thomas Howard, Paddington, near Sydney, New South Wales, Australia. Patent 1,969,647.

Tools and Attachments

Adjustable Arbor Support. Foster Treloar, Detroit, Mich. Patent 1,968,863.

Chuck. Robert S. Brown, New Britain, Conn., assigned by mesne assignments, to the New Britain-Gridley Machine Co. Patent 1,969,687.

AUGUST 14, 1934

Metal-Working Machinery

Horizontal Boring Machine. Keith F. Gallimore and Garner H. Schurger, Fond du Lac, Wis., assigned to Giddings & Lewis Machine Tool Co. Patent 1,969,791.

Hydraulic Wheel Feeding Mechanism. Wallace H. Wood, Worcester, Mass., assigned to Norton Co. Patent 1,969,997.

Crowning Attachment for Roll Grinding Machines. Howard W. Dunbar and Carl G. Flygare, Worcester, Mass., assigned to Norton Co. Patent 1,970,000.

Reaming Machine. Lora E. Poole, Anderson, Ind., assigned to General Motors Corp., Detroit, Mich. Patent 1,970,018.

Lathe. Clement J. Schroeder, Rockford, Ill., assigned to Sundstrand Machine Tool Co. Patent 1,970,023.

Machine for Grinding Splined Shafts, Gear Teeth, and the Like. John Wildsmith Snarry, Handsworth, Birmingham, England, assigned to the Gear Grinding Co., Ltd., Birmingham, England. Patent 1,970,060.

Back Pressure Control Mechanism for Machine Tools. Kenneth C. Monroe, Hudson, Mass., assigned to the Lapointe Machine Tool Co. Patent 1,970,181.

Screw Slotting Device. Andre Bechler, Moutier, Switzerland. Patent 1,970,216.

Unit Spindle Bearing Assembly. Edward P. Bullard, Fairfield, Conn., assigned to the Bullard Co. Patent 1,970,276.

Headstock Unit. Edward C. Bullard, Southport, Conn., assigned to the Bullard Co. Patent 1,970,277.

Grinding Machine. Robert R. Guempel, Hasbrouck Heights, N. J., assigned to General Motors Corp. Patent 1,970,453.

Tools and Attachments

Testing Fixture for Gear Cutters. Schuyler H. Earl, Rochester, N. Y., assigned to Gleason Works. Patent 1,969,837.

Gear Cutter. Joseph Gstyr, Rochester, N. Y., assigned to Gleason Works. Patent 1,969,841.

Cutter for and Method of Cutting Gears. Ernest C. Head, Rochester, N. Y., assigned to Gleason Works. Patent 1,969,843.

Tool Holder. Henry E. Morton, Muskegon Heights, Mich. Patent 1,970,016.

Tool Chuck. Edward J. O'Flaherty, Detroit, Mich. Patent 1,970,056.

Safety Device for Die Presses. Harry C. H. Walsh, Chicago, Ill. Patent 1,970,262.

Processes

Method of Broaching and Broach Therefor. Carl P. Halborg, Detroit, Mich., assigned to Colonial Broach Co. Patent 1,969,977.

Method and Apparatus for Making Tubular Rivets and the Like. Roy J. Freter, Toms River, N. J., assigned to Tack Button Co. Patent 1,970,085.

Manufacture of Nuts from Balls. Wilhelm Nussbaum, Dusseldorf, Germany. Patent 1,970,430.

American Machinist

REFERENCE BOOK SHEET ©

Dressing and Truing of Grinding Wheels

Courtesy of the Carborundum Company

Definitions

Truing may be broadly defined as any operation performed on any part of a wheel to create concentricity or parallelism or to alter the wheel shape, either before or after a grinding period.

Truing may be accomplished with any dressing tool, provided it is rigidly fixed in relation to the point of contact with the wheel.

Dressing may be defined as any operation performed on a wheel face to change the nature of its cutting action.

Wheel Dressers

The Huntington or star-type of dresser has pointed disks loosely mounted on a pin, with solid circular disks as separators. This type is exclusively used for dressing coarse grit wheels for snagging and off-hand grinding and frequently for dressing segmental-surface grinding wheels.

A corrugated disk (zig-zag) dresser is similar to the Huntington dresser, except that the disks are cast in a corrugated pattern and mounted without spacers. Intended for use where the work does not require the extreme, open structure produced by the star type, it tends to shear off the grains rather than to tear them from the wheel. Hence, its field is limited to the smoothing of roughing wheels.

The locked-disk type consists of a number of cut steel disks with elongated teeth or a number of cast disks with serrated or zig-zag edges, either of which is locked in sets and rigidly mounted without spacers on a pin supported in suitable bearings. The function of this tool is to remove partially the abrasive grains to a common level and slightly to open the bond. Limited in its field to medium roughing wheels it still has a wide range of application, including dressing of wheels for cam and crankshaft grinding, centerless grinding of bar stock and bolts.

The precision steel type is frequently used in place of diamonds for commercial grinding. It consists of a solid steel shell or cylinder mounted on accurate bearings. These cylinders have diagonal grooves spiraling in one or both directions, or a series of evenly spaced openings. Single-grooved tools are used for the peculiar wheel face required for the fine grinding of cast iron, while the double-grooved and holed types are well suited to the grinding of fine commercial surfaces, finishes on tappets, guides and general cylindrical work.

Abrasive dresser sticks are of two shapes—square for hand manipulation and round for magazine mounting. The square shape is well adapted to common grits and grades of toolroom wheels for grinding reamers, and mills and miscellaneous cutting tools, Blanchard vertical surface wheels and special shaped wheels.

Magazine-mounted sticks are of advantage in the toolroom for forming wheels to various patterns for profile grinding and for dressing or truing wheels of thin section. Either type may be economically used for the truing or dressing of dual-purpose wheels for roughing cuts when a diamond is to be used for subsequent finishing cuts.

Abrasive wheel dressers consist of silicon-carbide wheels rotatably mounted in a suitable holder with high grade bearings. They will in many cases entirely replace the diamond for such grinding operations as on pistons, camshafts, crankshafts, axleshafts, bolts and many commercially fine finishes on the centerless grinder. Their use imparts a smooth, clean cutting face which leaves no dressing marks on the work.

F' Rating	*Wheel Diameter*	*Wheel Face*	*Grit*	*Grade*	*Bond*	*Abrasive*
1	Up to 6"	1"	40 to 80	Soft	Vit. and Sil.	Al. Ox.
2	6 to 12"	2"		Medium	Shellac	
3	12 to 16"		90 and Finer			
4	16 to 20"	3"			"Redmanol"	
5	20 to 24"					
6	24 to 30"	4"	12 to 36	Hard	Rubber	Sil. Carb.
7	30 to 36"					
8	36 to 40"	5"				
10		6"				
12		7"		Very Hard		
14		8"				
16		9"				
18		10"				

VALUE OF TOTAL RATING "F," IN CARATS

"F" Values	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48
Carats	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8

EXAMPLE OF HOW TO APPLY ABOVE TABLE TO TYPICAL WHEELS

	Dia.	*Th.*	*Grit*	*Grade*	*Bond*	*Abrasive*	*Total "F"*	*Size Diamond*
"F"	24 5	6 10	50 1	I 2	G6 1	Sil. Carb. 6	(Wheel) 25	4 Carats
"F"	12 2	1 1	80 1	R 1	24 1	Al. Ox. 1	(Wheel) 7	1 Carat

Dressing and Truing of Grinding Wheels

In its practical application, care should be taken to prevent the dressing wheel from passing off or out of contact with the grinding wheel face. This would cause the dressing wheel to gouge the grinding wheel when it again comes into contact at a diminished speed. Another reason for this precaution is that as the contact area decreases, the penetration becomes deeper. The angle at which the tool is set bears a very important part in the results desired and obtained. For general use an angle set from 5 to 7 degrees from the vertical.

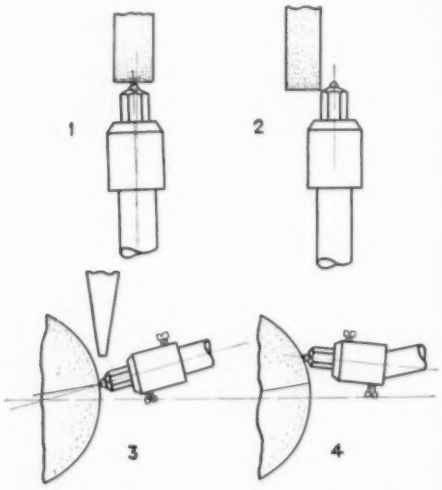


Fig. 1—Correct approach of diamond. Fig. 2—Incorrect approach from side. Fig. 3—Proper position of coolant nozzle and correct angle setting. Fig. 4—Incorrect angle setting; stone may gouge the wheel

Industrial Diamonds

Selection of diamonds for quality for truing and dressing is not properly a shop function. Approximately 85 per cent of the factories use African brown bort, grey bort and ballas stones. Best-quality brown bort stones are recommended for inexperienced operators, because such stones are less brittle and will withstand reasonable wear.

There are six factors to consider in the selection of proper size diamonds: Wheel diameter, thickness of wheel face, grit, grade, bond and abrasive. The total rating "F" in the accompanying table gives the key to diamond size. Recommendations for specific applications follow:

Small internal wheels—brown or grey stones in long, natural points, $\frac{1}{16}$th to $\frac{3}{4}$ths carat. Reset at least once to obtain advantage of both points.

Small external wheels — Octahedron shaped Brazilian stones from $\frac{1}{4}$ to $1\frac{1}{4}$ carat for hard fine wheels, and Octahedron brown or grey for softer wheels. With this shaped stone, the points are of great value. When worn, use for other classes of wheels.

Gear grinding wheels—Use only the finest selected brown or Brazilian Octahedrons. These stones must be selected by experts for this class of dressing.

Thread and hob grinding wheels—This service requires elongated shapes, natural points or sharp splints, best selected by experts.

Diamond dressing tools should always be used at an angle to the wheel face, and to the direction of wheel rotation. Either one of two angles may be used, depending on the type of tool.

The first and most important angle is one intended to prevent chatter in the tool, gouging the wheel face, and damage to the stone. This is usually referred to as "canting." Refer to Fig. 5. Set the diamond holder on the radial line with its sides parallel to the wheel side. Assuming that the diamond point is in contact with the wheel on this line, raise the rear end of the tool vertically, in the direction opposite the direction of wheel rotation, making an opening between the radial line and the tool axis of from 3 to 15 deg., thus forming angle *A*. If in doubt as to the exact radial line, drop the point to a position not more than $\frac{1}{4}$ in. below the supposed line. Never have this contact point above the radial line. With this setting it is necessary to rotate the tool point on its own axis to maintain a point on the stone.

The second angle, Fig. 6, is intended to make the diamond self-sharpening, and to avoid diamond marks on the wheel face. This angle constitutes a movement out of the vertical plane. Again assuming that the diamond point is in contact with the wheel face, move the rear end of the tool horizontally, making an opening of 30 deg., angle *B*, between the tool axis and line, or 60 deg. from the wheel face. With this angle the stone assumes and maintains a 60-deg. included angle. As the stone is rotated, it presents a sharp but broad edge to the wheel, which will dress openly but free of diamond "threads." Here, too, the stone should be slightly below the radial line, rather than above.

Very frequently the wheel face is worn convex or tapered. It is good practice to contact the stone on the wheel at the highest point before traversing, with infeed, to prevent excessive penetration.

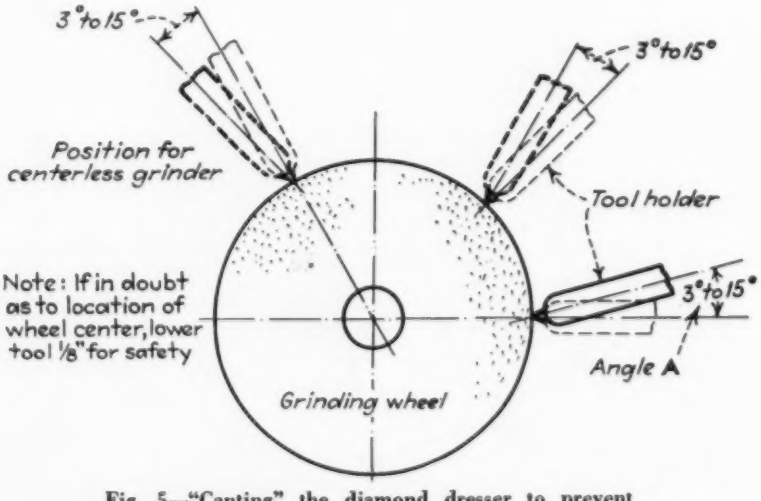


Fig. 5—"Canting" the diamond dresser to prevent gouging the wheel face, chatter and stone damage

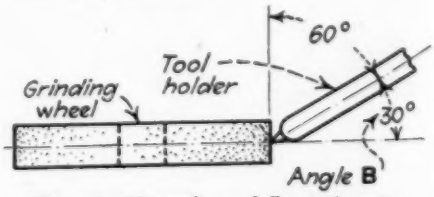


Fig. 6—"Second angle" setting to make diamond self-sharpening and to avoid diamond marks

Fooling Yourself on Tool Costs

HERBERT CRAWFORD

THOSE of us who look back to the days when firearms and sewing machines were the only examples of mass production, have seen many changes in shop organization. Then nearly everyone made their own bolts and screws, and frequently made them with odd pitches with the mistaken idea that it insured profits from repair work. Following this we began to buy bolts and screws from specialists, even though standardization was unknown and one maker made his quarter-inch bolts a thirty-second large "because a quarter-inch bolt was too weak." The one- or two-man pattern shop in the plant and the small foundry gave way to independent establishments until today it is unusual to find a shop with its own foundry.

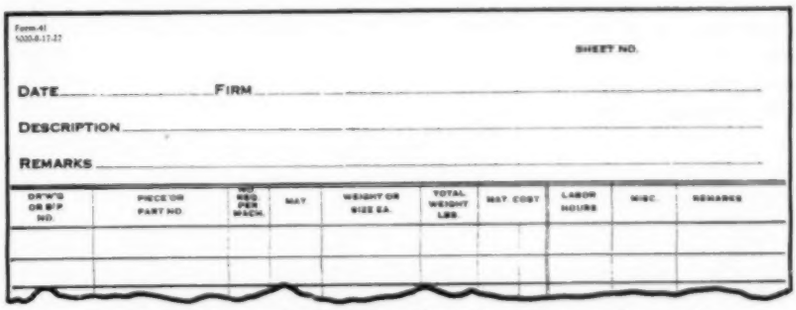
From making all our own tools we have now come to buying standard drills, reamers, taps and cutters, with rare exceptions. We seem to have passed the numerous epidemics of making milling cutters from old car or locomotive axles with case hardened or carburized teeth, even though we frequently heard claims of their economies as compared with "store" cutters. After several unsuccessful attempts we now have makers of standard jig bushings, who carry stocks running into the hundred thousands and only on rare occasions do we make our own. In the same way we often go to outside shops for special tools, jigs and fixtures, even when we have a well equipped toolroom in our own shop. We are not apt to do this except when the amount of work is beyond our capacity even though it might pay better than we know.

Overgrown Toolrooms

Having your own toolroom is a tradition in nearly all shops. And considered from the viewpoint of securing quick repair or adjustment of tools needed, it is usually justified. But we are very apt to let it get out of hand and nurse it along until it grows far too big for regular business. Then we sometimes try to keep it busy by taking in outside work. Even this wouldn't be so bad if we figured costs as they really are. But whether we are figuring costs on our own jobs to impress the management with the money we save by doing the work ourselves, or to get jobs away from regular tool shops, we frequently figure altogether too low.

Overhead, that term that is used so much and means so little at times, is the common stumbling block. Large manufacturing concerns maintaining a toolroom use from 40 to 50 per cent of direct labor as overhead. Anyone familiar with details knows that this does not cover overhead costs which are rarely under 100 per cent, and frequently more, if all costs strictly chargeable to the toolroom are considered. The costs charged against the toolroom may include the foreman's salary and some allowance for power, floor space, heat and light. But it seldom takes into account that the toolroom uses some of the time of the purchasing agent, the receiving room, order clerks, executives, office, paymaster and others in the plant. These items, which the independent tool shop must consider, are usually charged to general manufacturing overhead.

The same fallacy exists when considering estimates for tools or fixtures from outside concerns. The average shop bases its estimate for its own work principally on material and labor with a few items of overhead. It is probably safe to say that in no case is the overhead charged in the estimate the same as would be considered necessary on the regular product of the plant. The shop which depends on contract work for a living must include all costs, including that of securing business enough to stay in business. This should be remembered when we compare their estimates with those of our own toolroom.


SHEET NO.

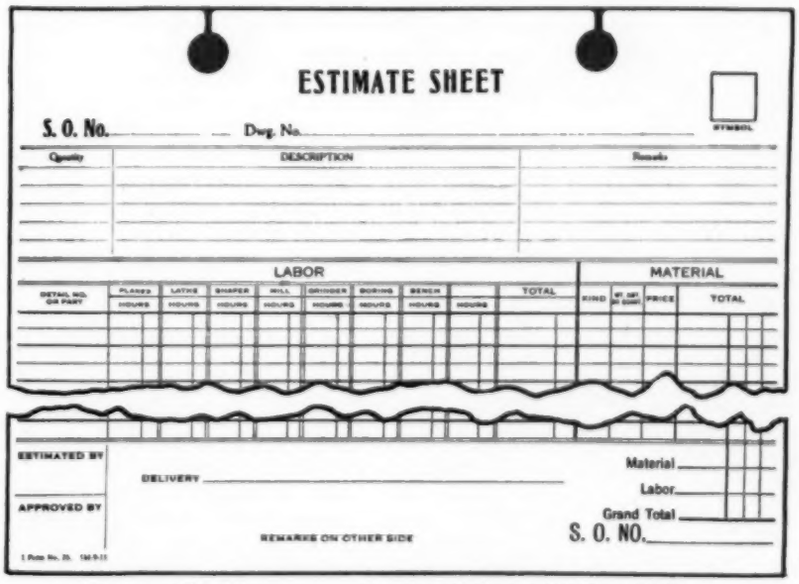
DATE FIRM

DESCRIPTION

REMARKS

DR'W'G OR P/P NO.	PIECE OR PART NO.	NO. REQ. PER MACH.	MAT.	WEIGHT OR SIZE EA.	TOTAL WEIGHT LBS.	MAT. COST	LABOR HOURS	MISC.	REMARKS

Fig. 1—A form of estimating that gives a general record of the items involved but lumps all labor in one column


ESTIMATE SHEET

S. O. No. Dwg. No. SYMBOL

Quantity	DESCRIPTION	Remarks

	LABOR									MATERIAL			
DETAIL NO. OR PART	PLANER HOURS	LATHE HOURS	SHAPER HOURS	MILL HOURS	GRINDER HOURS	BORING HOURS	BENCH HOURS	HOURS	TOTAL	KIND	NO. OF PCS. REQ'D	PRICE	TOTAL

ESTIMATED BY

APPROVED BY

DELIVERY

REMARKS ON OTHER SIDE

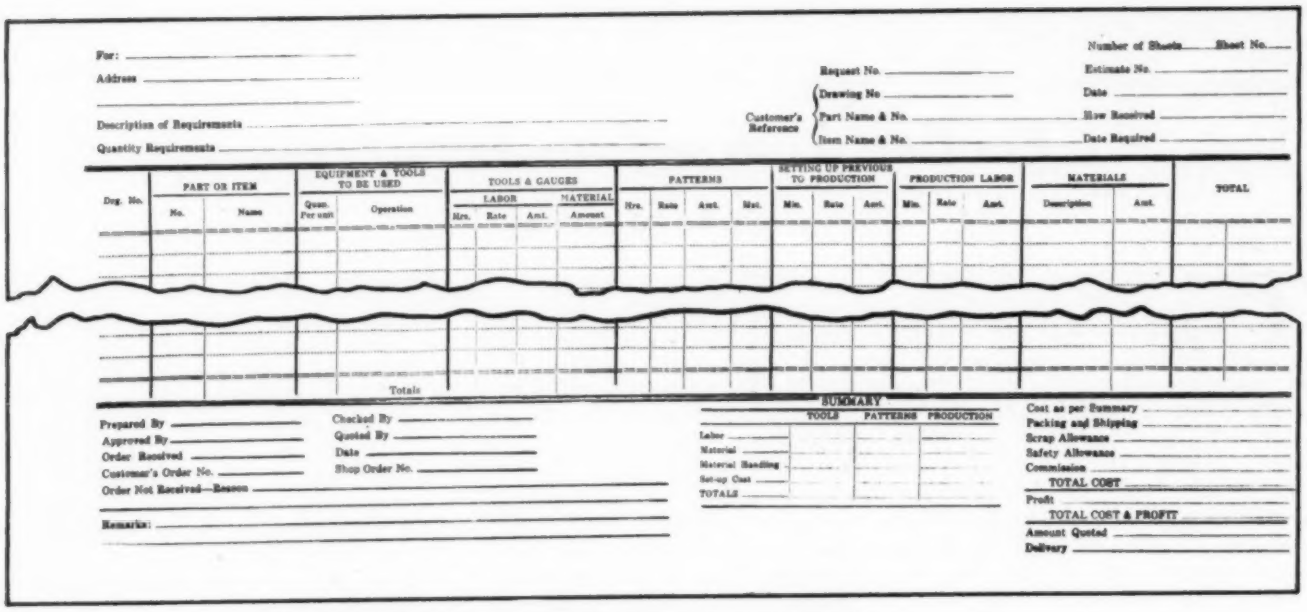
Material

Labor

Grand Total

S. O. NO.

Fig. 2—This form segregates the different kinds of labor on each part and gives more details of material used



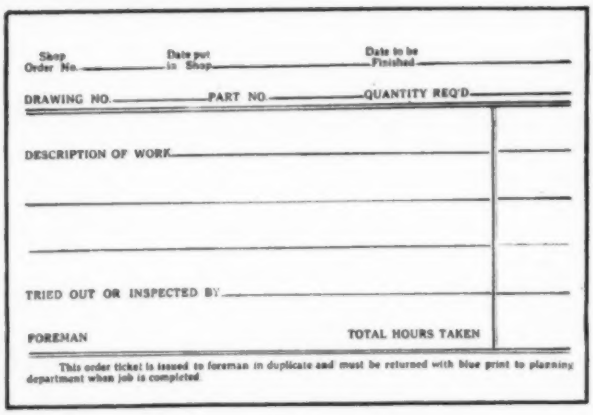

Shop Order No.
Date put in Shop
Date to be Finished
DRAWING NO.
PART NO.
QUANTITY REQ'D
DESCRIPTION OF WORK
TRIED OUT OR INSPECTED BY
FOREMAN
TOTAL HOURS TAKEN
This order ticket is issued to foreman in duplicate and must be returned with blue print to planning department when job is completed

Fig. 3—Above—A still more elaborate estimate sheet that should prevent overlooking any of the items in the total cost. Fig. 4 — One copy goes to the foreman and one copy to the planning department

While nothing but an accurate knowledge of the factors that make up overhead in each plant can give complete information on this phase of the costs involved, it is probable that even some of the definite costs are frequently overlooked. Just to enable us to check up easily on this, two estimate sheets, as used by well known tool shops are illustrated. The estimate sheet in Fig. 1 gives a record of the general items, but lumps all labor under one column. This might be called a summary of the estimate for record. In Fig. 2, on the other hand, labor is classified into seven general divisions and one column is left for special work, if necessary.

Still another estimate sheet, from a well known maker of special tools and fixtures, is shown in Fig. 3. This divides the kinds of work in a somewhat different manner, the equipment and tools used showing the work to be done. By designating the machine or tool number in this column it makes it easily possible to differentiate as to the overhead to be charged on various machines, on jobs where flat rate of machine overhead does not seem advisable. Careful attention to all the details given will prevent overlooking items or operations that go to make up the total costs.

The various points are again brought out in the summary while the last summing up includes such items as packing and shipping, scrap allowance and the margin for safety and commission together with the profit expected. Such a sheet as this not only serves as a check to prevent overlooking any of the items involved but it can be a guide in future estimating as well as making a record that may prove of great value in dealing with similar problems or in keeping tabs on customers. This concern also has card records of work as it progresses, job cards for the foremen and the men and special envelopes in which all the data can be filed together for future reference. These records are not frills in any sense. They are necessary in the proper conduct of a business. Without them it is very easy to overlook costs that should be charged against the job. And the cost of suitable records should be considered before deciding that the outside shop that bids for work is asking an exorbitant price.

On individual jobs such as making a die, tool or fixture a shop card should accompany the drawing and the order when it goes to the foreman. Such a card is seen in Fig. 4. This shop uses two of these cards, one is white and used by the planning department to show the foreman the time the job should take. A similar card, but yellow, goes to the workman. On this card the foreman puts the time he allows for the job, which is frequently less than that of the planning department. Should the foreman feel the time allowed on the white card is not sufficient, he returns the cards to the planning department. When the job is finished both cards go back to the planning department together with the drawing so as to give a check on the actual time taken.

Summing up the situation we may say that each job should have a designating number to which time and material should be charged. There should be an accurate timekeeping system to insure proper time being charged to each job.

A proper stores system must be used and material issued only on a requisition which shows the shop order number. The cost department puts the price on the requisition which is put in the cost envelope until the job is completed. The estimator, or estimating department must have charts, tables or other data showing cutting speeds, feeds and cuts that can be taken by the different types of machines in use.

A careful study of the data shown by such estimate sheets as have been shown is very likely to show items that have been overlooked in a hurried guess at the cost of a job. Whether the job is to go outside or be done in the plant, it is well to get in the habit of knowing approximate costs, not only of the whole job but of separate operations. Fooling yourself is not only poor policy, but it is decidedly unfair to the other fellow.

• IDEAS •
FROM PRACTICAL MEN

Three Useful Tools for the Toolmaker

C. F. FITZ

For adjusting toolmakers' buttons, the small hammer in Fig. 1 is very convenient. The head is copper. The handle is heavy catgut, giving the hammer the necessary resiliency to prevent it from striking the button too hard.

When filing die openings to layout lines, the file throws up burrs that must be removed. For removing the burrs, the circular scraper in Fig. 2 is very efficient. It is made of tool steel, hardened and tempered and is ground to give it a sharp cutting edge. The face can be ground either flat or slightly concave. If a file is used to remove the burrs, there is danger of obliterating the layout lines, but with this scraper there is no such danger.

In making templets, considerable time can be saved by the use of the triangular scraper in Fig. 3. The base *A* is machine steel and the scraper *B* is tool steel, hardened and tempered. The sides can be ground either flat or slightly concave. The scraper is attached to the base by one flat-head machine screw, so that when one edge becomes dull the scraper can be turned to bring a fresh edge into position. In use, the base can be screwed to the bench or held in the vise. When the temple has been worked close to the layout lines, it can be finished by laying it flat on the base and working it carefully past one of the sharp corners of the scraper. When the templet is finished, the edges of the contour will be square with the sides.

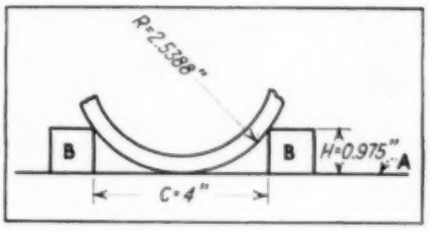
Finding the Diameter Where the Center Is Not Accessible—Discussion

F. M. A'HEARN

Referring to the many discussions under the title given above, and particularly to the ones by John Roll and Elmer Olson (*AM*—Vol. 77, page 790 and Vol 78, page 420 respectively), it is my opinion that Mr. Olson's method is the easiest to remember of any of the several submitted.

Referring to the accompanying illustration; on any plane surface *A* place two parallels *B* of equal and known thickness. Put the segment on *A* and bring the parallels into contact with it, as shown. The distance between the parallels is the chord *C* of the arc; the height in this case being assumed as 0.975 in. Any other chord or height covering the dimensions of the segment will answer equally well when handled as Mr. Olson suggests.

With the chord *C* and the height *H* known, the radius of the segment can be found by the following formula: $\frac{C^2}{8H} + \frac{H}{2}$ and the diameter can be found by multiplying the radius by two.



Dimensions necessary for finding the radius of a segment of a circle. The problem can easily be solved by the formula given in the text

Where rolled shapes are to be bent into circles of say 50 ft. or more in diameter, the use of full-sized templets is impracticable, nor is space always available for establishing a center. In such cases, the accuracy of such circular bends can be found by the use of tape or wire to measure the chord *C* and the height *H*, using the formula given.

Concave Grinding

AVERY E. GRANVILLE

Some time ago we had a quantity of steel flats to harden and then to grind on all four sides, one side to be concave. This last requirement had us puzzled for awhile, but while we were trying to figure out how to do it we went ahead with the straight part of the job.

We then clamped a large toolpost grinder, fitted with a cup wheel, to the head of the shaper ram, the work being clamped to the table, as shown in the

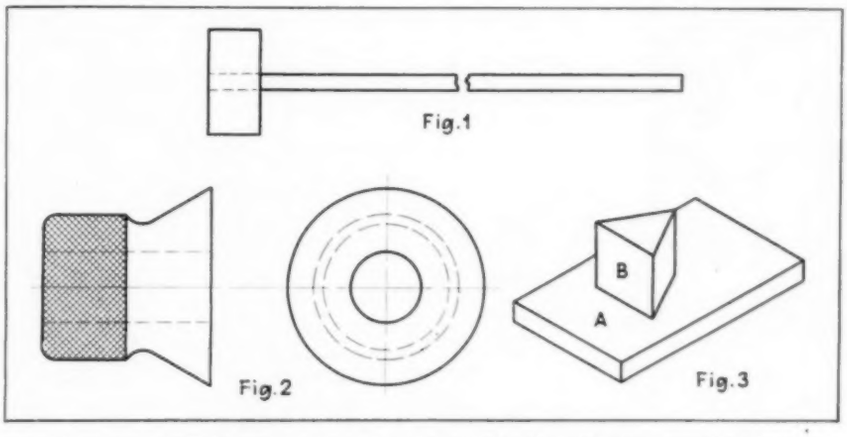
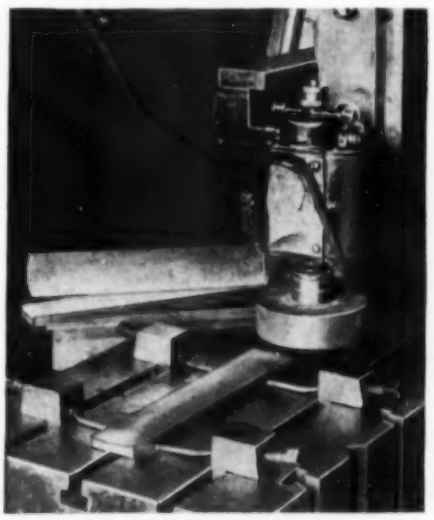


Fig. 1—Small hammer for adjusting toolmakers' buttons. Fig. 2—Scraper for removing burrs thrown up by a file in filing die openings. Fig. 3—Templets can be finished by laying them flat on the base and working them past one edge of the scraper



The grinder was tilted so that the wheel ground partly on its face and partly on its side, making a concave cut

illustration. By wedging out the upper part of the grinder, its spindle was inclined so that the wheel ground partly on its face and partly on its side, making a concave cut. After a few trials the grinder was wedged out just enough to get the amount of concavity required.

Press Tools for Slotting

J. E. MOORE

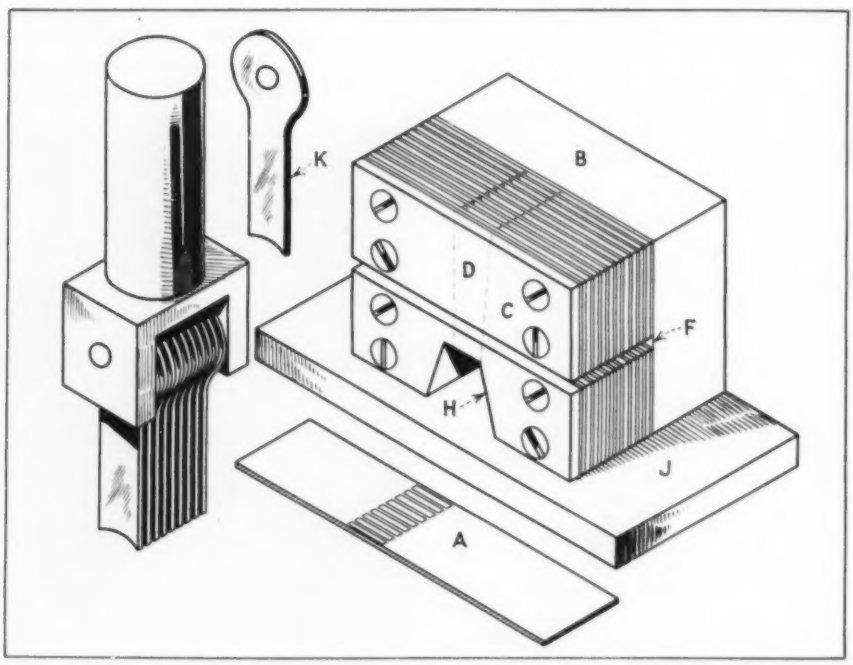
The press tools illustrated were made for punching a series of slots in the zinc strip *A*, 0.025 in. thick. The die is built up of laminations of automobile steel, held to block *B* by screws through the cover plate *C*. The laminations are of two thicknesses, one set being the same thickness as the width of the slots to be punched, while the alternate ones are of the same thickness as that of the webs between the slots.

In making the die, at first the thick plates only were screwed to block *B* and a ½-in. slot was milled through them in the direction of the dotted lines *D*, cutting the plates in two. After removing the thick plates they were reassembled to block *B* with the thin plates between them, forming a series of slots. Then with a slitting saw, slot *F* was cut through both the cover plate *C* and the laminations, making a channel for feeding the work. At the same time, the laminations above the slot acted both as a stripper and as guides for the punches, while the laminations below the slot formed the die proper. The punchings fell into the channel *H*. Block *B* was attached to the die-shot *J* by screws.

The punches were made by grinding end pieces of old power-hacksaw blades to the shape shown at *K*. They were assembled in the punch-holder and held by a pin. The punches were ground to the same thickness as the width of the slots to be punched and were separated by washers of the same thickness as that of the webs between the slots.

The tools were used in a hand press and the punches were entered into the slots in the die laminations, the press stroke being so adjusted that the punches would not come out of the die when the ram was at the top of its stroke.

Boys in one of the public schools at Wichita, Kan., made these tools in the machine shop attached to the school.

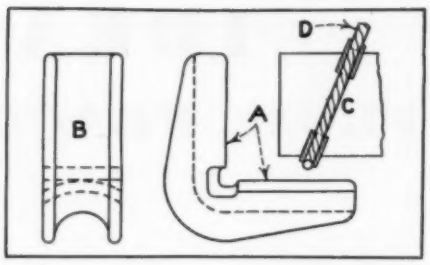


Laminations form the die, the stripper and the guides for the punches. The punches are made from ends of old hacksaw blades and are assembled with washers between them

Old Tires Protect Castings Discussion

MATTHEW HARRIS

Reading the article under the title given above by J. B. Sheppard (*AM*—Vol. 78, page 279), brought to mind devices that were intended not so much to protect the load being hoisted as to protect the slings, when rope slings were more common than were chain slings. Rope slings would be chafed and cut by the sharp corners of castings, boxes and crates, and chafed slings are always an element of danger because one never knows how weak they may be.



The protectors will prevent rope slings from being chafed and cut by the sharp corners of castings, boxes and crates that are to be hoisted

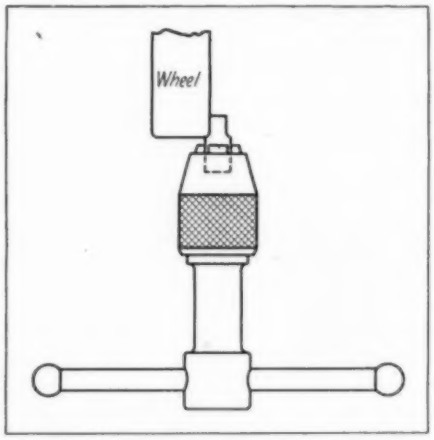
Four castings such as the one illustrated are put under the lower corners of anything having sharp corners that is to be hoisted; two for each sling. The inner surfaces *A* are rounded at *B* so that the protectors will rock and follow those parts of the slings that incline toward the crane hook, as at *C*. While it is necessary to round only the surface *A* that contacts with the under part of the load, both surfaces are rounded so that it makes no difference which way the protectors are placed.

In the case of rough castings having sharp corners at the top, protecters can be put on the upper edges to protect the slings where they angle across the top of the load toward the crane hook, as at *D*. The protectors can also be used with chainslings.

Grinding Short Toolbits

HENRY J. APPEL

No more burned or ground finger tips. Just put that short toolbit in the chuck of a tap wrench to hold it while grinding. By using the tap wrench as a holder, it is possible to grind the tool-



Injury to the fingers in grinding short toolbits is eliminated by holding them in the chuck of a tap wrench

bit to just the size and clearance desired.

I have used this method of holding ⅛-in. toolbits as short as ⅛ in. It can't be beaten for grinding toolbits for internal threading and keyseating.

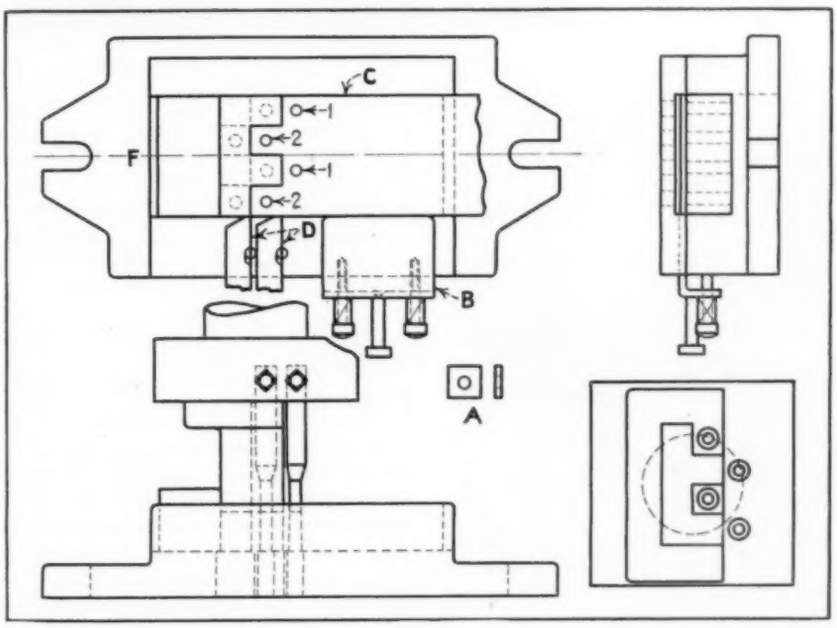
Press Tools for Piercing and Blanking Nuts

H. R. SCHMIDT

Press tools for piercing and blanking small, thin, square nuts, like the one at *A*, are shown in the illustration.

In the plan view of the die, the stripper has been omitted for the sake of clearness. A pressure pad at *B* keeps the stock against the rear guide *C*. Movable stops at *D* are used in starting the work, and a fixed stop *F* is used after the first two strokes of the ram.

In operation, the pressure pad *B* is pulled out to admit the stock, which is advanced against the first of the stops *D*. With the stock in this position, the two holes marked 1 are pierced at the first descent of the ram. The first stop *D* is then pulled out and the stock is advanced against the second stop *D*. When the ram descends for the second time, the holes marked 2 and two other holes marked 1 are pierced and two pierced nuts are blanked. The second stop *D* is then pulled out and the stock is advanced against the fixed stop *F*. When the ram descends for the third time, and at each descent thereafter, two holes marked 1 and two marked 2 are pierced and four pierced nuts are blanked, the stock being advanced against stop *F* just before each stroke of the ram. Thus no stock is wasted.



By staggering the punches for piercing and blanking, four pierced nuts are blanked at the third stroke of the ram and at each stroke thereafter

SEEN AND HEARD

JOHN R. GODFREY

Modern Heating Torches

The old blow torch and bunsen burner have jointed the ranks of ancient and honorable relics in most localities. Even in far off Korea and other equally distant points the modern welding and cutting torch is now to be found. While the oxy-acetylene flame is too hot for much of the work formerly done with the old apparatus, modifications have been developed that fit many lines of work. For low flame temperatures, such as soldering, a combination of air and acetylene is now used. Cutting requires a hot flame, and oxy-acetylene is used for this work. Other combinations are used on special cases. Brazing or bronze welding is also playing an important part both in joining parts together and in building up worn portions.

SAE Threads on Shop Equipment

At least one prominent manufacturer of machine tools has adopted the SAE, or national fine thread, as standard on all threaded parts, excepting those where the design requires a fast lead. For most positions, there is ample room for a thread length of a good two and a half diameters so the strength of the fine thread is ample. With this practice, there is less likelihood of parts coming loose, thus insuring maximum rigidity at all times.

An additional reason for the use of fine threads is the fact that most of this manufacturer's output goes to the automobile industry. Since the auto shops are well supplied with SAE taps and dies, parts can quickly be made when there is any occasion to make special attachments for the machines or to supply new parts.

Specifications for Men

When most of us start to write specifications we seem to drop automatically into some foolish ways of expressing ourselves. A recent ad for a high grade man insisted that he must be employed at present. Of course what the advertiser wants is a man who is good enough to be able to hold a job even during the depression. Strictly speaking this would bar out the best man in the country if the concern he was with had folded up without warning—as too often happens. Then, too, it overlooks the kind of management that fires a very good man because his efficiency has so reduced direct labor cost that overhead has passed some mysterious percentage deadline. The very best man who had chucked an unsatisfactory job last Saturday, would not be eligible according to the specifications.

Pretty Fine

Wire is now being made at the Prescot Works of the Bristol Insulated Cables, Ltd., with a diameter of 0.002 in., or finer than a human hair. Fifteen and a half miles weigh only a pound. In addition to the wire drawing machinery, equipment has been installed to coat the wire with enamel insulation according to *Industrial Britain*. Five coats have a thickness of only 0.0002 in.

How Much Chatter?

Once in a while we hear of vibration helping a tool to do a better job. It has even been suggested that we put a vibrator on a lathe tool. And the "chatter" press was a vogue a few years ago. But the trend seems to be the other way. One of the advantages claimed by users of broaching is the freedom from chatter. One job that looks simple, cutting half round grooves in shifter bars for automobile transmissions, is a case in point. It would seem easy to hold these rigidly and mill them without difficulty. But a big production man tells me it wrecks a heavy miller in short order while a broach makes no fuss at all over the job. On the other hand, we are sure to get overenthusiastic and try to broach some job we ought to mill. That's the way we work out the best answer to many production problems.

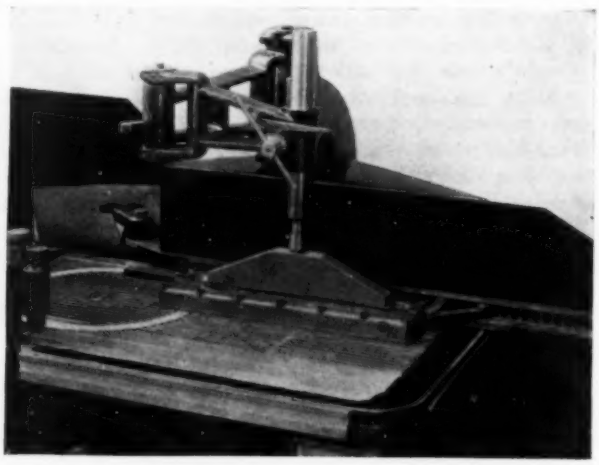
SHOP EQUIPMENT NEWS

Osterholm Horizontal Surface Grinder

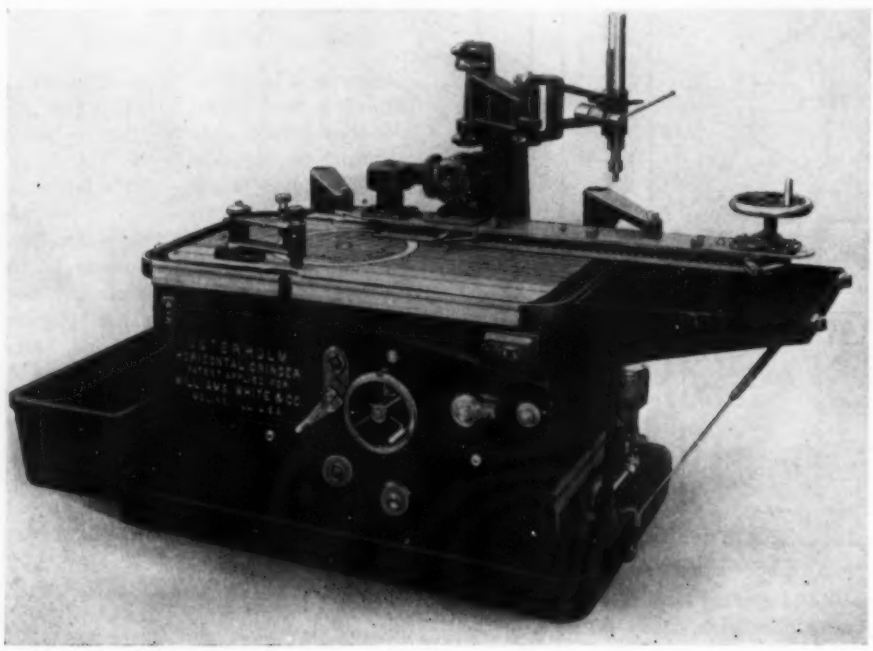
An unusual type of surface grinder, which is designed to accommodate a large variety of work without elaborate fixtures, is announced by the William, White & Co., Moline, Ill. It is said that this machine can be used in the production line or in the toolroom, and for refinishing operations or for grinding rough castings. It is offered for the finishing of such parts as washing machine castings, cylinder blocks, cylinder heads, agricultural implements, for grinding the bevel edge on cutter knives and special adaptations.

The table of the grinder consists of three parts; namely, the feed table, the circular plate support which is a stationary member mounted on a column extending through the spindle to the base pan, and the take-off table. These tables are ground to a true plane. The ring-type wheel is set so that it is flush with the top of the center plate. The depth of cut is regulated by adjusting the height of the feed table relative to the wheel. Work passing from the feed table across the wheel to the center plate and the take-off table travels in a true plane and a flat surface results. The work is prevented from lifting by its own weight or by a hold-down, which is provided, and the work is passed over the wheel at a uniform rate by means of the mechanical feed that consists of a motor-driven chain with work-driving lugs. The rate at which the chain moves is variable by means of change gears.

The ring wheel is mounted on a vertical spindle that is direct-motor driven. That is, the motor is pressed directly on the spindle, and perfect balance is obtained. The spindle and its housing are mounted in vertical guides in a frame and can be raised to compensate for the wear of the wheel by means of a graduated handwheel and screw. The weight of the spindle is counterbalanced to facilitate adjustment. The feed table rests on tapered ways, and is raised or lowered by moving the table to and from the wheel by a crank with micrometer adjustment. Table surfaces are deeply grooved so that the work wearing surfaces will not collect grinding débris. Water is introduced to the spindle where it is dispersed through ducts in the center plate to the point of contact of the work on the wheel. Thus, hardened parts can be ground without danger of warping or loss of temper. Coolant is forced through the center plate by pressure supplied by the motor driven centrifugal pump in the base pan. An auxiliary pan collects débris before the fluid is returned through the base pan to the pump.



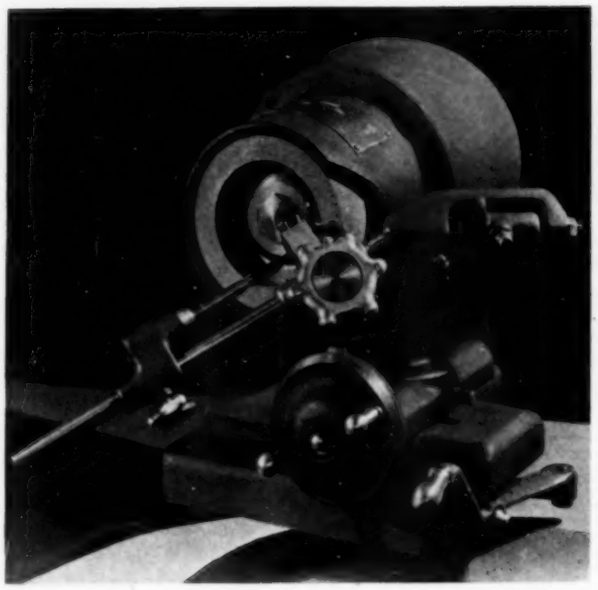
Below—The feed table at the right is adjusted vertically for the cut. Right—Using the hold-down for grinding a cylinder head



Sellers No. 05D Drill Grinder

Built as a smaller companion to its line of larger drill grinders by Wm. Sellers & Co., 1600 Hamilton St., Philadelphia, Pa., the No. 05D unit uses the same basic principle but in a modified form. It will take drills up to ½ in., and is of the self-contained dry type with direct-connected, built-in, inclosed motor of ⅜ hp., 110 or 220 volts.

Especially designed for rapid handling



Sellers No. 05D Grinder for regrinding and reclaiming drills up to ½ in.

of small drills, the chuck holds the drill at three points as hardened steel jaws grip the edges of the flutes. An adjustable back center supports the end of the shank. The handwheel illustrated opens and closes the chuck which grips mechanically, no hand pressure being needed after it is closed.

The chuck holds the drill so that its axis is in correct relation to the wheel to provide clearance increasing from the periphery to the point of the drill. Rotation is less than 180 deg., and the drill is reset so that each lip is in the same position for grinding in order to secure identical lips and concentricity of the drill point. Rough and finish grinding is done in one operation, thus making regrinding of dull or broken drills, or reclamation of small drills, an economical operation. The grinding operation which passes the drill back and forth across the face of the 5-in. cup wheel tends to maintain the flat surface of the wheel.

Alemite lubrication is supplied, and the pushbutton control has overloaded protection. The weight of the machine including motor is 110 lb., and it occupies an overall space 16x13x12 in.

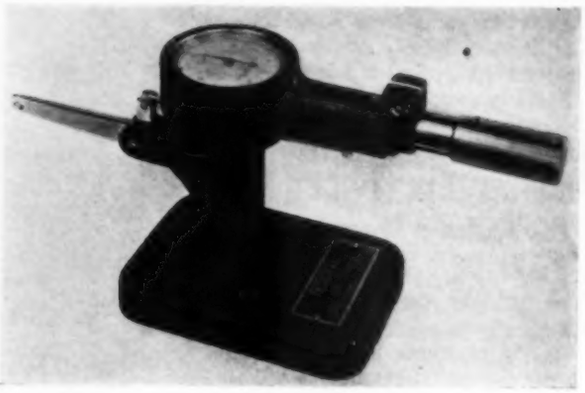
Williams, White Angle-Bending Roll

Williams, White & Co., Moline, Ill., are building a self-contained angle bending roll in which the roll shafts are placed vertically so that the angles can be worked in the horizontal position. The machine is self-contained, including motor, and can be mounted either on wheels or casters.

A handwheel on the operator's side of the machine adjusts the front rolls. A handwheel in front of the machine is arranged for quick return of the moveable roll. Handwheels are located on each side for raising and lowering the side supporting rolls and for adjusting them horizontally for different radii on the angles. Standard rolls are adjustable for all angles within the capacity of the machine. Special rolls can be furnished for rolling I-beams, channels, T's, Z bars, flats on edge, rounds, squares, pipe, tubes and miscellaneous shapes. The standard rolls will handle flats on flat and T's in the plane of the web or flange. Any of the above parts can be rolled in coils. Four sizes of the machine are built.

Federal Model 166 Small-Hole Gage

The Federal Products Corp., 1144 Eddy St., Providence, R. I., is now marketing a Model 166 small-hole gage which is a two-point contact, dial-micrometer, plug gage for measuring small diameters as well as for detecting out-of-round, bell mouth and taper conditions. Plugs can be furnished for any size from 0.200 up to and including 1½ in. The plugs can be changed in less than 1 min., and the standard length range is from 2¾ to 5¾ in. Special lengths can be supplied for longer or shorter holes. The bench-type gage illustrated can be operated either by hand or by foot control, and the indicator is graduated in 0.0001 in. divisions. The dial is movable for setting. This gage can be furnished in a portable type with a pistol grip in place of the stand.



Goodrich Liquid Belt Dressing

The B. F. Goodrich Co., Akron, Ohio, has developed a liquid belt dressing for rubber belts that merely softens the rubber surface but does not penetrate and deteriorate the body of the belt. The dressing increases pulley grip and horsepower delivery. For several years, castor oil was an accepted dressing for rubber belts. Certain leather belt dressings were also used on rubber belts with inefficient and usually harmful results.

Williams, White No. 3 Angle-Bending Roll with capacity of 6x6x⅜ in. angles, legs out, and 5x5x⅜ in. angles, legs in

The very thing that made oil effective on leather, its ability to lubricate the entire thickness of leather, often induced ruinous results on rubber belting.

Landis 2-In. Pipe-Threading Machine

A combination pipe- and bolt-threading machine, named "Little Landis," is being announced by the Landis Machine Co., Waynesboro, Pa. The Landis diehead patent tangential chasers are employed. The machine is of the lathe type in which the work is revolved. It is designed to thread, ream and cut off pipe and thread bolts and rods. The features are light weight, quick set-up changes and economical operation.

The machine is made in the motor-driven type only, employing a 1-hp. motor and industrial-type control. The motor is mounted in a compartment in the bed and connected to the geared headstock by means of a silent chain drive. The gearbox by which three changes of speed are available is cast integral with the spindle housing for rigidity. The cross-rail that supports the diehead and cutting-off and reaming tools is integral with the carriage. A scroll chuck of three-jaw universal type is employed.

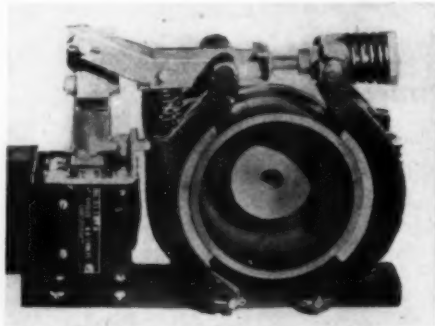
Two dieheads, having combined capacity of ¼ in. to 2 in., are furnished. By applying bolt chaser holders, the 2-in. head can be used for threading bolts from ⅜ to 1¼ in. The dieheads are adjusted for diameter through a self-locking ratchet screw.

"Rigid Back" Inserted-Blade Milling Cutters

The Cowles Tool Co., Cleveland, Ohio, is introducing a "Rigid Back" milling cutter in 8 different styles and 51 sizes. For rigid support of the inserted cutter blade, the back face of the blade is ground flat and the supporting surface in the body of the cutter is also ground flat. The front face of the blade has serrations that match serrations on the tapered wedge. When assembled to the cutter body the combined blade and wedge form a rigid dove-tail tooth. The blade is adjusted by driving the wedge out and resetting the blade to the proper diameter. Repeated sharpening of the blade can be accomplished. Cutter bodies are made regularly of heat-treated alloy steel and are equipped with high-speed steel blades. Cemented-carbide-tipped blades can be furnished. The method of holding blades is also adapted to the design of special cutting tools.

Maintenance pipe and bolt threading is done on the "Little Landis"

Back surface of blade is rigidly supported by ground surface in the hardened steel body



A.c. and d.c. solenoid-operated brakes are interchangeable

Attachments available for Whitney Conveyor Chains

Improved Union Bessemer Screw Steel

The Union Drawn Steel Co., Massillon, Ohio, has announced that it has developed a process for the manufacture of Bessemer screw steel by which it has largely eliminated the abrasive elements which tend to wear away the cutting edges of tools. This advancement has been accomplished without change in analysis and without affecting the physical properties of the material. While no higher feeds and speeds are claimed beyond those already obtainable with steels of these analysis, this development is said to have effected production economies through extension of tool life and elimination of frequent machine shutdowns. The process is now being employed in the production of both "Free Cut" (S.A.E. 1112 Type) and "Supercut" (high sulphur) bessemer screw steels.

Cutler-Hammer Small Electric Brakes

Three new sizes of small a.c. and d.c. solenoid-operated brakes have recently been placed on the market by Cutler-Hammer, Inc., Milwaukee, Wis. The torque ratings, which range from 3 lb.-ft. to 75 lb.-ft., are in accordance with NEMA standards, conforming closely to the full load torque ratings of small standard motors.

The brake wheel which is relatively large, allows low total brake shoe pressures giving even wear of the friction surfaces. This also results in low stresses on all pins and pivot points, assuring longer wear for these parts and allowing the use of a small operating solenoid, which requires less current, thereby affecting a slight saving in operating cost of the brake.

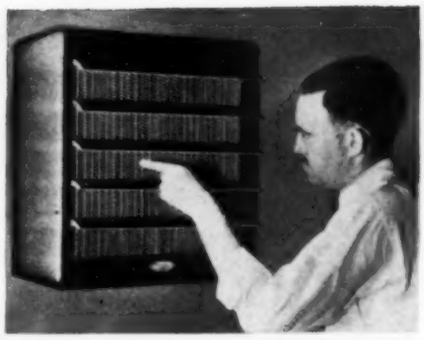
Dimensions of the a.c. and d.c. brakes are interchangeable.

Whitney Conveyor Chains

The Whitney Manufacturing Co., Hartford, Conn., is making a line of conveyor chains in two series with standard and oversize rolls and both in four different sizes. The chain utilizes the standard roller chain construction with an extended pitch. Attachments can be easily applied to particular applications. Series 500 and 550 chains operate over sprockets, but the use of a large diameter roll on the 550 series allows it to be used as a drag or pressure chain, with the rollers carrying the load. Pitches of these chains range as follows: 1½, 2, 2½ and 3 in.

Fedders Unit Heaters

Announcement of their Series 3 line of unit heaters with improvement in design, quietness and appearance is being made by the Fedders Manufacturing Company, Buffalo, N. Y. Streamline tubes, patented fins and sturdy cabinets combined with resilient motor mountings eliminate resonance and isolate vibration. Header tanks have integral baffles to assure even steam distribution throughout the element. Full floating mountings maintain the alignment of the heating element within the cabinet, eliminate expansion stresses between element and cabinet and protect the element from piping strains.

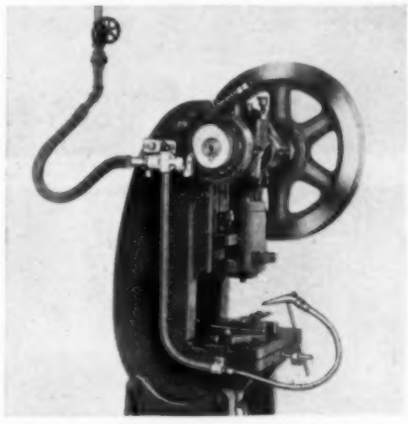


A full-floating mounting protects the heating element

Littell Air Valve For Punch Presses

The F. J. Littell Machine Co., 4127 Ravenswood Ave., Chicago, Ill., is making an air valve in which a powerful air blast is released by means of a roller running against a cam that is located on the crankshaft of the press. This cam is set so that the air shuts off when the press stops at the top of the stroke. This arrangement makes it necessary to change the location of the valve trip each time that an adjustment of the press slide is made.

A flexible metallic-lined hose connects the air valve with the air nozzle. The nozzle is supported by a universal clamp which enables the operator to clamp the nozzle at any height, and locate it left or right, front or back, by merely tightening one wing nut. The valve is adaptable to hand-fed and automatically fed punch presses.



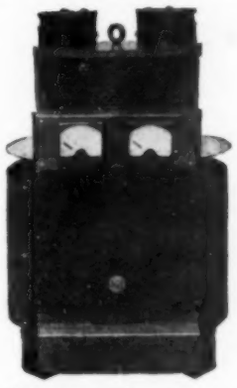
The air blast is shut off at the top of the stroke by a cam

General Electric A.C. Arc-Welding Equipment

The General Electric Co., Schenectady, N. Y., now has available a complete line of a.c. arc-welding equipment in addition to its line of d.c. arc-welding equipment. The a.c. line includes transformer units, electrodes and automatic welding heads and controls. This equipment is intended for heavy current welding, primarily automatic welding because of the heavy currents involved, but is also suited to hand applications.

A.c. arc welding is not new, but the development of arc-welding electrodes during the last few years has only made it possible recently to benefit from the major advantage of the a.c. process, that is, the absence of magnetic blow in the arc, and therefore superior quality in the resulting weld. This advantage becomes particularly apparent with the heavier welding currents, above 250 amp., because of the greater magnetic effect at these currents. Slightly greater welding speeds are possible when using a.c., and in making fillet welds and in working into corners and other parts of intricate structures, the a.c. arc permits full penetration.

The transformer units are available in three sizes, having one-hour ratings of 500, 750 and 1,000 amp. Primaries are wound for 220, 440 or 550 volts, 60, 50 or 25 cycles, single phase. Extra attachments are available for reducing the secondary open-circuit voltage to approximately 50 per cent of its normal value (normal being 80, 90, or 100 volts), and for obtaining currents down to 10 per cent of the one-hour rating. The transformers are of the high-reactance type, air-cooled and inclosed in a cylindrical shell. An arrangement is provided to vary the reactance so that the full welding range of the equipment can be obtained on any one of three secondary open-circuit voltage settings, the latter being selected by means of taps on the primary winding. The electrode recommended for the a.c. process is the Type W-23, a heavily coated electrode suited to a.c. welding.



A.c. welding transformers are made in three sizes: 500, 750, and 1,000 amp., one-hour rating. Primary taps change the voltage

Link-Belt "Silverstreak" Silent Chain

In keeping with today's trend toward greater thought to the aesthetic in designing even the commonest machinery part, Link-Belt Company, Indianapolis, Ind., announces that it has given a "new dress" to a 32-year-old product, the "Link-Belt Silent Chain Drive," by bluing most of the chain, and treating the washers and guide bars to give them a silvered appearance. The bluing of the bulk of the chain has the effect of placing the silvery parts on a dark blue background, thereby emphasizing the silvery parts. The trade name "Silverstreak" has been adopted, since when the drive is in operation the motion of the chain describes a silvery streak. It is made in all standard types.

Complete blue-print equipment for 9 by 12-in. prints

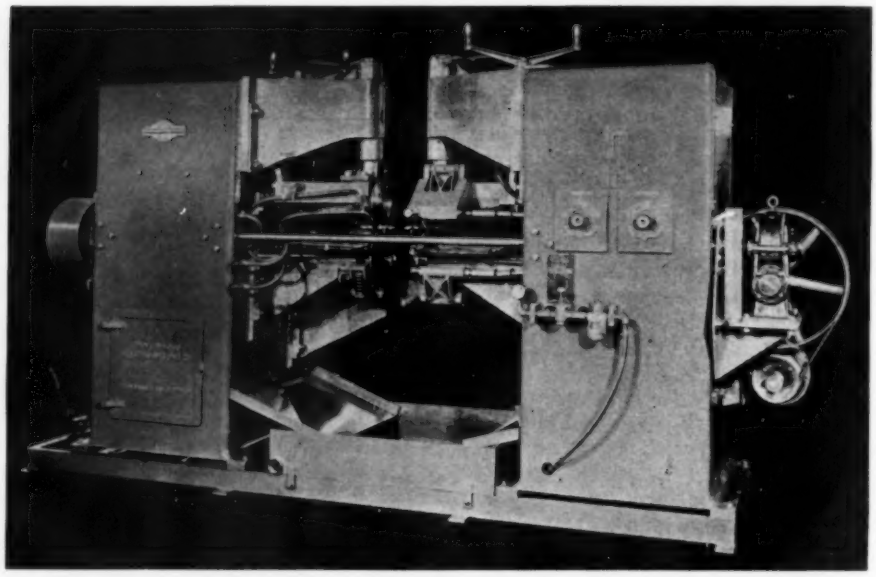
"Speedway" Blue Printer

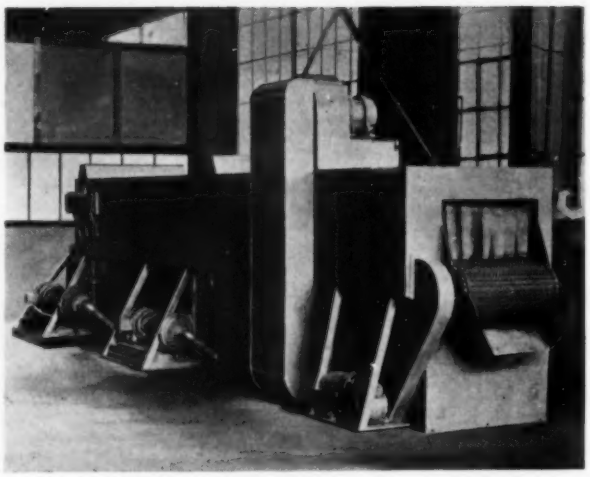
The F. A. Smith Mfg. Co., Inc., Rochester, N. Y., has developed a compact blue printer for making blue prints of 9x12 in., or any intermediate size. The device will make one print per minute, the tracing and blue print paper being fastened to the glass door. It can be obtained with a cabinet fitted with necessary developing and washing trays and with a print dryer.

Thomson-Gibb Seam Welder

A duplex seam welder that joins a forging to each end of a tubular shock absorber housing has been developed by the Thomson-Gibb Electric Welding Co., Lynn, Mass. This machine welds both ends of the housing at the same time. Each of the two units that comprise the complete welder makes two welds in series. Actually the machine makes four seam welds simultaneously so that the housing is rotated only one-half revolution to complete the work.

The machine is equipped with special work-holding and aligning fixtures to assure accuracy, and with a special quick-acting tail stock for speeding up the handling of the work. Welding wheels are driven by knurl or friction drives that keep the speed constant. Both the work and welding wheels are cooled by a flood cooling system. Both units of the machine are operated by a single, variable-speed motor and are powered by 100 kva. transformers.





Above — Four seam welds are made simultaneously on this duplex welder

Left — Work travels through the conveyor tunnel at the rate of 20 ft. per min.

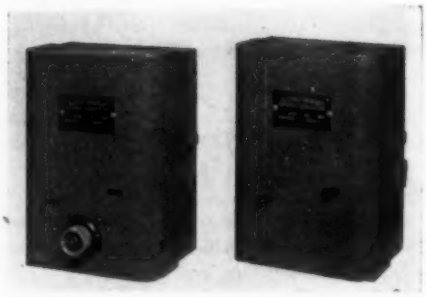
Below — Accidental starting of the motor is prevented by recessing the start button in the larger stop button

Ransohoff Continuous Washing Machine for Metal Parts

A continuous-type washing machine for cleaning metal parts—stampings, castings, forgings and machined parts—has been introduced by N. Ransohoff, Inc., Cincinnati, Ohio. Work enters the machine from a belt or chute and travels through the equipment on an endless woven-wire conveyor. This flexible-mesh belt, with double selvage edges, runs over drums at loading and unloading ends, is supported by track and rollers and makes the return trip within the housing, thus preventing the water from dripping to the floor. The work travels through the conveyor tunnel at the rate of 20 ft. per min.

Five operations are involved in cleaning the parts—a wash, drain, rinse, second drain and drying. Washing compound and rinse water are sprayed onto the work from top and bottom through perforated pipes which extend from the sides of the machine for ease in cleaning. Cleaning compound is pumped from a tank in the bottom of the machine equipped with skimming dam to eliminate scum. The compound is heated by steam coils on three sides of the tank.

The rinse water tank is served by an individual pump, has a skimming dam and is heated by the exhaust from the wash tank through perforated pipes extending from the steam coils. Following the rinse, the work is given a final spray with hot water from the plant's regular water line. It then is subjected to blasts of hot air from slotted pipes above and below the conveyor, the air circulating back to the steam coils for re-heating and provision is made for controlling the amount of fresh air drawn in. Four motors drive wash pump, rinse pump, blower and conveyor.



Lincoln Automatic Motor Starters

A line of automatic motor starters, which positively prevents accidental starting and which permits taking full advantage of the motor's capacity without danger of burning it out, is announced by The Lincoln Electric Company, Cleveland, Ohio. These starters are of the across-the-line type.

It is impossible to close the starting current unintentionally due to the design of the control. The red stop button extends around and beyond the green start button. Consequently, a bump or fall against the control would move only the stop button. Once the motor is stopped, the only way it can be restarted is by pressing the recessed start button with the fingertip.

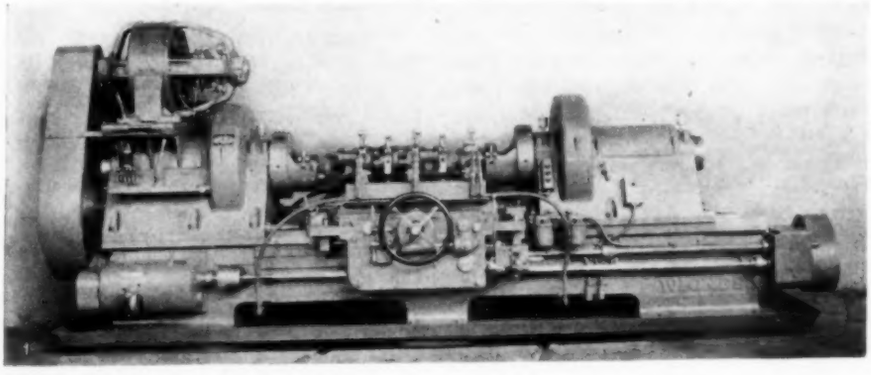
Full advantage of the motor's capacity is permitted by inverse time-limit protection which allows carrying a small overload a long time or heavy load momentarily. Quick motor staring upon resumption of current is insured by low-voltage release with two-wire control. The starters are furnished in three types for different horsepowers and 110, 220, 440 and 550 volts. Mechanical parts are protected from rust by cadmium plating.

"Cecolloy" Iron Alloys

The Chambersburg Engineering Co., Chambersburg, Pa., has developed a series of nickel-molybdenum, air-furnace iron alloys, under the trade name of "Cecolloy." While similar alloys have been used in smaller castings, the company found no previous data available on castings as large as those required in hammer practice. The research undertaken required the development of a reverberatory type of furnace for the production of high strength alloys, capable of maintaining the exceptional temperatures necessary during the rather extended period of carbon conversion. Characteristics of Cecolloy are homogeneous grain structure, a tensile strength of 40,000 to 60,000 lb. per sq. in., and a Brinell hardness which can be controlled to suit the purpose for which the casting is intended. Carbon content can be controlled within 0.05 per cent plus or minus. Castings up to 50 tons can be made and the alloy is offered for such castings as forming dies, beds for heavy duty machine tools, steam cylinder liners and rings, hydraulically operated gates and valves, crushing machinery, rabbling equipment, feed-hoppers and chemical vessels.

Wickes 38-In. Duplex-Type Double-End-Drive Crankshaft Lathe

For machining unusually large tractor, airplane and diesel crankshafts, the Wickes Bros., Saginaw, Mich., are now building a 38-in., heavy-duty, duplex-type, double-end-drive crankshaft lathe which weighs 22,000 lb. The 38-in. lathe is provided with front and rear cross slides, having front and rear tools, and with power cross feed and power longitudinal feed through a quick-change gearbox. The machine is provided with automatic split feed and automatic diameter stop as well as power rapid cross traverse and power rapid longitudinal traverse. A 25-hp., variable-speed, d.c. motor with automatic speed control through field rheostats is furnished. Thus, it is possible to maintain a constant cutting speed of the tool bits during the long cheeking operation from the beginning of the cut at the outside diameter of the cheek to the finish of the cut when turning the diameter of the pins or main bearings. The motor is controlled through a start-stop-jog pushbutton station mounted near the apron. Steadyrests support the head-end and tail-end pot chucks to eliminate chatter.



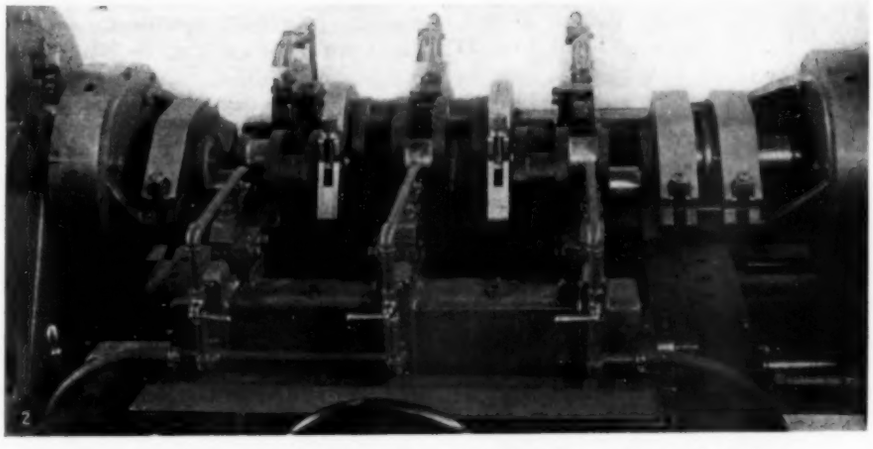


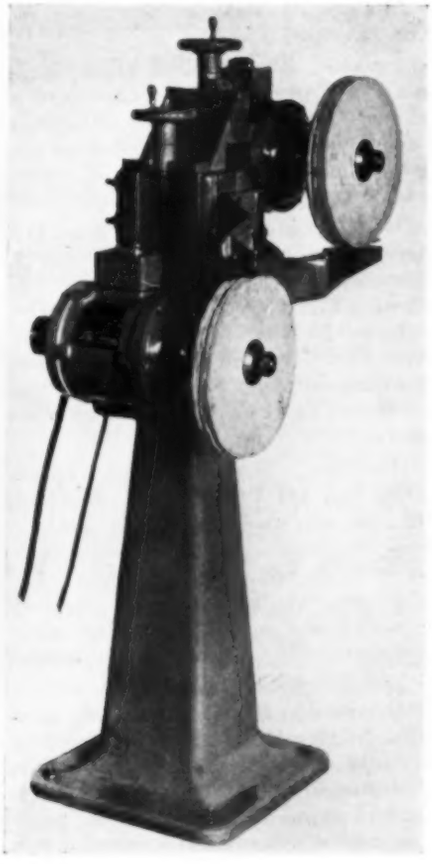
Fig. 1—Wickes 38-In. Heavy-Duty, Duplex-Type, Double-End-Drive Lathe for machining large tractor, airplane and diesel crankshafts
Fig. 2—Close-up of the tooling equipment arranged for machining the Nos. 2, 4 and 6 main line bearings. Steadyrests are provided on the Nos. 3 and 5 line bearings.

Standard Strip Cleaning and Polishing Machine

To permit cleaning and polishing both sides of strip steel in one operation the Standard Electrical Tool Co., 1938 W. 8th St., Cincinnati, Ohio, is now offering a strip steel cleaning and polishing machine. This is a production unit for use in connection with electric hardening and tempering furnaces.

The method used is to have one machine to clean the scale, the buffing wheels having emery glued to their faces, and another machine to polish the strip. Vertical adjustment is provided to compensate for wheel wear. A guide shoe is located on each wheel.

The machine can also be used on wire of all sizes.



• TRADE • PUBLICATIONS

BEARINGS. The engineering section of the complete anti-friction bearings catalog of the Bantam Ball Bearing Co., South Bend, Ind., complements the sections dealing with specific bearing types and gives detailed illustrated information concerning the various methods of bearing application and the detailed design of the component parts. Fatigue life methods of estimating probable bearing service, bearing steel and its proper heat-treatment are fully discussed. A section is devoted to steel mill roll neck bearings and various methods for mounting shafts using different types of thrust and floating bearings.

BENCH LATHES AND ATTACHMENTS. Circular No. 363-A, published by the Pratt & Whitney Co., Hartford, Conn., gives a complete description of many ways in which the Pratt & Whitney bench lathe may be used, including the application of the many attachments and tools that go with this machine. One of the new features is a compact two-speed gear box to increase the versatility of this equipment.

BORING AND HONING MACHINES. Bulletin No. 133, available from the Barnes Drill Co., Rockford, Ill., discusses the combined fine boring and honing machines having hydraulic feeds and reciprocations.

CHUCKS. The Thurston Manufacturing Co., Providence, R. I., has issued a circular on the improved Thurston double end mill chuck. This gives the sizes of chucks offered, details of design and a table of capacities.

DIE CASTINGS. A booklet, "Brass Die Castings with the Strength of Steel," has been published by the Doehler Die Casting Co., Toledo, Ohio. The booklet tells briefly what brass die-castings are and what they will do. It points out that certain pieces can be made by this method which can be made in no other way.

DRILLING MACHINES. The Barnes Drill Co., 814 Chestnut St., Rockford, Ill., has published Bulletin No. 126 giving additional information on its progressive production drilling units. The discussion of these machines is very complete and several illustrations show the possibilities in the way of special production set-ups.

GRINDING WHEELS. The Carborundum Co., Niagara Falls, N. Y., has issued "A Treatise on the Dressing and Truing of Grinding Wheels." This 47-page booklet defines dressing and truing of grinding wheels, discusses the various types of dressing tools, applications therefor, industrial diamonds, diamond dressers, the correct application of diamond tools. General rules for miscellaneous truing and dressing and information on procedure for specific classes of grinding are also included.

FILES. A revised edition of "American Swiss Files of Precision" is being distributed by the American Swiss File & Tool Co., 410 Trumbull St., Elizabeth, N. J.

METAL-WORKING MACHINERY. List No. 83 issued by J. L. Lucas & Son, Inc., Bridgeport, Conn., shows the stock of rebuilt machine tools on hand.

PACKING. Catalog No. 16 has been issued by Greene, Tweed & Co., 109 Duane St., New York, N. Y., showing the brands of packings carried as well as the "Favorite" reversible ratchet wrench, the "Basa" soft-faced hammer, and the "Empire" rawhide mallet, the Rochester Automatic Force Feed Lubricators, belt fasteners, walrus and other polishing leathers.

PHOTO-RELAY. Catalog Sec. 43-950 published by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., describes the Type LE Photo-Relay, its application, construction, operation, specifications, and list prices.

PIPE THREADING MACHINES. A bulletin describing the "Little Landis" Pipe Threading and Cutting Machine has been prepared by the Landis Machine Co., Waynesboro, Pa. The machine is designed for jobbing and maintenance threading.

P.M.G. METAL. The Cramp Brass & Iron Foundries Co., Paschall Station, Philadelphia, Pa., has issued a leaflet on "P.M.G. Metal" for castings, forgings, rods and shapes. The alloy is a silicon bronze which is offered as a substitute for bronzes containing tin.

PNEUMATIC TOOLS. Bulletin 2037-A, issued by the Ingersoll-Rand Co., 11 Broadway, New York, N. Y., lists for the first time this company's new sizes of "Multi-Vane" drills and "Multi-Vane" push-throttle screw drivers and nut setters. It also illustrates and gives size and capacity tables of the Ingersoll-Rand pneumatic drills, grinders, riveters, chippers, rammers, wrenches, hoists, etc. The title of this eight-page bulletin is "The World's Most Popular Pneumatic Tools."

PORTABLE TOOLS. Catalog No. 37 published by the Standard Electric Tool Co., 1938-46 West 8th St., Cincinnati, Ohio, describes electric drills, grinders, buffing and polishing machines.

SPEED REDUCERS. The Falk Corp., Milwaukee, Wis., has amplified the information published on its line of motoreducers with Bulletin No. 272. Data on the complete line is presented in one booklet and new installation and application photographs are included.

SPEED REDUCERS. Catalog No. 137 prepared by the D. O. James Manufacturing Co., 1120 West Monroe St., Chicago, Ill., shows its generated, continuous-tooth herringbone speed reducers and gears. The booklet is unusually complete and contains 95 8½x11 in. pages.

SPEED REDUCERS. The Universal Gear Corp., 19th and Martindale Ave., Indianapolis, Ind., has published Catalog No. 400 showing its complete line of "Heliocentric" and geared speed reducers, including a full range of motorized reducers.

TRUCKS, TRACTORS AND CRANES. The Baker Industrial Truck Division, the Baker-Raulang Co., 2168 West 25th St., Cleveland, Ohio is now distributing a loose-leaf catalog covering the complete line of industrial trucks, tractors and cranes. Each type of equipment is illustrated and described. Many photographs of typical applications are included.

TUBE COUPLINGS. Bulletin No. 37 gives a price list of the various tube couplings and associated equipment made by the Parker Appliance Co., Cleveland, Ohio.

V-FLAT DRIVES. The Dayton Rubber Manufacturing Co., Dayton, Ohio, has published Catalog No. 160 on its "V-Flat Drive" in which the large pulley is flat instead of grooved, the bottom surface of the V-Flat belt riding on the flat surface of the large pulley.

WELDING. Under the title of "The Shielded Arc," the Lincoln Electric Co., Cleveland, Ohio, discusses the shielded arc method of welding from the standpoint of metal structure, physical properties, and method of doing the work.

WELDING. "The Maintenance of Reciprocating Parts," published by The Linde Air Products Co., 30 East 42nd St., New York, N. Y., deals with the application of the oxy-acetylene process of wear-resisting bronze to the wearing surfaces of sliding parts. The advantages of bronze surfacing as an economical means of reclaiming pistons and similar wearing parts are fully set forth, giving examples in different fields. Other sections of the booklet discuss frequency of application, characteristics of certain applications, the importance of wear-resisting bronze welding rod, and a complete description of the correct procedure to be followed in the resurfacing operation.

WELDING RODS AND ELECTRODES. The Rich Manufacturing Co., Ltd., 3851 Sante Fe Ave., Los Angeles, Calif., issued recently a small catalog on its "Stroco" welding rods and electrodes.

THE ROUND TABLE

Rolling Your Own

"Why all the flossy drawings, Al?" said Ed as he came into the office and saw several on the desk ready to be wrapped for mailing. "Going to make jigs and fixtures for a living instead of pumps?"

"Not at all, Ed. These fixtures are for some of our pump parts. I'm getting them ready to send out for estimate."

"Why don't you make them yourself, Al? You can hire a few extra men if you need 'em. But why send it out when you can do the work yourself?"

"I'll admit it's a great temptation, but I'm strong for the old saying about a 'shoemaker sticking to his last.' Williams could have built a pump that might have answered his purpose. But he bought one of mine instead. Do you roll your own cigarettes, Ed?"

"That's different, Al. You have a patented pump that's good. Nothing is patented about fixtures—anybody can make them."

"Not good fixtures, Ed. We've both seen homemade fixtures that might better have been in the scrap heap. They lost us time and cost us money every time we used them, but we nursed them along because we made them ourselves."

"I'm surprised you'll admit your men can't make good fixtures, Al."

"I don't admit it; I believe they can. But I also believe that shops which specialize in that work can do a better job for less money."

"But they'll cost a lot more if you have them made outside."

"I doubt it, Ed. The trouble is we kid ourselves about the cost of things we make in our own shop. We usually charge only material and direct labor and no overhead. We think overhead would be there anyhow and just forget it."

"But what about the other fellow's profit, Al? You don't pay that when you make fixtures yourself."

"I'm not so sure, Ed. As long as the independent tool shop is in business, and we'd be in a bad way if there weren't any, it has to make a profit. And we pay it; if not on one job then on another. If we gave them all our work the profit per job would be less. As it is, they have to tack it onto such jobs as they get."

"You talk like a college professor, Al, or perhaps I mean an economist."

"Don't make it any worse than you have to. But then it might be a compliment, Ed."

"Funny thing, Al. Williams talked the same way the other day, but I still can't see it."

"Now that is a compliment, Ed. Two of them in fact. And the job goes outside."

Is Al right about sending his work outside? Or can he make fixtures cheaper in his own shop?

Discussion

Works Councils and Unions

I should favor a works council in preference to a national union. The disadvantage of a national union is that it is controlled by the industry as a whole, and decisions may be made by men who are not actually engaged in the industry. Individual plants are not catered to. While each plant or city would send delegates to the union conference, the contact between the union heads and the workers is not sufficiently close to cope successfully with many of the problems. Too often the good of the union is put before the interest of many of its members. Where labor disputes are dealt with by a national union, a dispute in one plant might involve the whole industry with disastrous results to all concerned.

With works councils, the disputes in a plant would be confined to that plant, and other plants would not be affected, as they would not be drawn into the dispute. From the point of view of both workers and employers, the works council would be the most beneficial.

As to whether the men join a works council or a national union, the matter should be put to a vote and for all men to accept the verdict of the majority.

—W. E. WARNER,
Garden City, Hertfordshire, England.

Hourly Pay vs. Piece Work

There are decided differences between piece work, bonus, premium work and straight hourly pay. Before deciding which to adopt, the quantity of product and many other conditions should be taken into account. The management should make a thorough study of the plant to see which system will fit the best. Any plant manufacturing a regular line can increase output, reduce ma-

chining and assembling time and develop a more efficient organization through one of these systems than by day work. The size of the shop does not make the difference; it is the conditions and the quantity manufactured.

Manufacturers of automobiles are paying hourly wages in assembly lines where conveyors carry a certain number of units past a given point per hour.

No one system is adaptable to all manufacturing, but where there is a certain incentive to work, a means will be found for turning out more work. The brain will be developed, lost motion will be cut out, and a habit will be formed of making every move count. All these things will develop an efficiency that was never imagined.

Al's best choice would be the bonus system, as it gives every man an incentive to help—and team work is essential in a small shop. —H. A. GILLILAND, *Mechanical Engineer, Hamilton, Ontario, Canada.*

From my experience I would recommend a combination piece-work and set-up method of paying men on production work. Under this system piece-work prices may be set practically the same as for continuous operation, and a fair set-up price set for each operation. After this, any size lots may be put through without refiguring the prices, as the man would be paid a set-up when starting the job and then a piece-work price for each piece completed regardless of their number.

At first this may seem like extra work, but in reality it is less work for the rate setter (with little extra work for the timekeeper), because once a set-up and piece price is established, no more pricing is required by the rate setter to take care of varying size lots.

The one danger in this system is the possible abuse or misuse of the set-ups allowed. This method of payment is equitable to both parties and eliminates the increased percentage of supervision required to produce economically under straight hourly rates.

The size of the shop does not make so much difference when considering the method of payment. It is the number of pieces per run and the frequency at which they are run that counts.

—C. F. STAPLES.

Subsidized Suggestions

While the example cited by Al is an extreme case, by far the greater part of suggestions cannot be made profitably available in any given plant. Most men are prone to regard their own ideas at more than their face value, and are likely to discount the ideas of others. When as fair treatment as is possible is adhered to, the feeling arises that partiality has been shown, and those who have offered suggestions in vain are likely to be disgruntled. By the time the general dissatisfaction accruing has been weighed against the benefits received, I am not at all sure that Al is wrong in his stand.

There will be ideas of value lying dormant in the minds of some men in almost any organization, but it does not follow that every man is a potential source of valuable ideas. Ideas are peculiar things and their adoption or rejection is often far-reaching. Some of them have as many aspects as a centipede has legs, and some that seem ridiculous in a certain light and from certain angles may, upon modification, prove to have real worth. Therefore, men should never be openly invited to offer suggestions unless one is willing to have them go into the matter fully and is willing to go into it with them in the same manner. —JOHN E. HYLER.

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